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February 12, 1931

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Frost Action in Highway Subgrades

Two articles describing practices in Michigan and Minnesota in the practical application of research data to prevent heaving and boils

Salvaging a 19,000-Ton Overturned Bridge Caisson

A Symposium of Views on Estimating Fees

Friction Losses in Steel Pipe

Report on Delaware River Diversion for New York Water Supply

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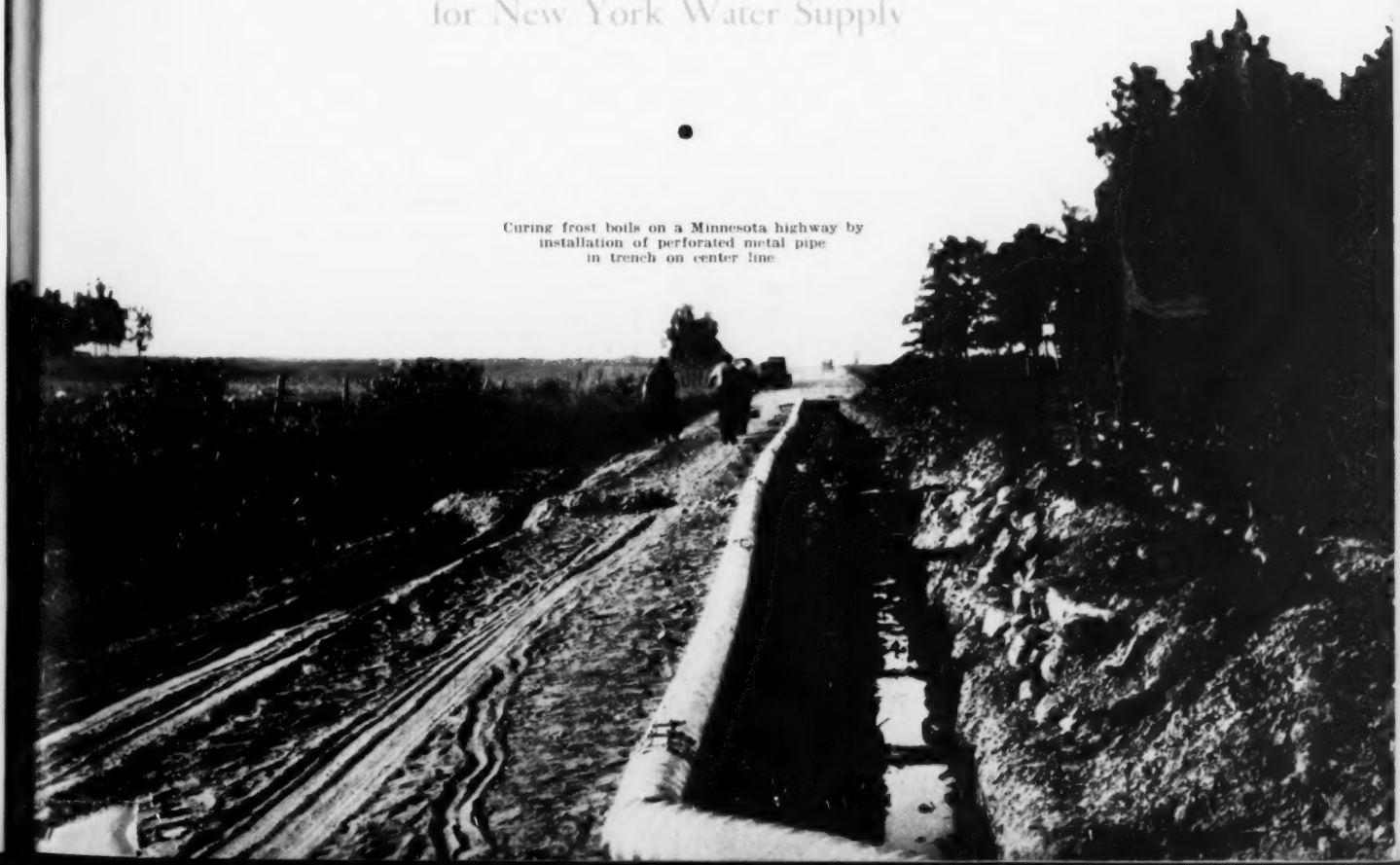

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Contents for February 12, 1931

VOLUME 106, NUMBER 7

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Frost in Road Subgrades 266

Frost Action in Silt Soils Defined
By V. R. BURTON AND A. C. BENKELMAN

Curing Minnesota Frost Boils by Drains
By C. L. MOTL

New Formula for Friction Losses in Steel Pipe 273

Overturned 19,000-Ton Caisson Successfully Salvaged 275
By GLENN B. WOODRUFF

Estimating Fees—A Symposium 281

Master's Finding on Delaware River Diversion 284

Annual Meeting, American Institute of Canada 287

Editorial 263 Letters 286 News 289 Equipment 295

Business News 297 Material Prices 300 Unit Prices 303

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

Volume 106 NEW YORK, FEBRUARY 12, 1931 Number 7

Views on Bidding Fees

THE question of charging fees for bidding has obviously important bearing on the welfare of the contracting industry. Elsewhere in this issue we present a symposium on the subject setting forth the views of engineers, contractors and contractors' associations. A survey of the opinions expressed shows that engineers and contract-awarding officials are practically unanimous in opposing the estimating fee system, and some view the plan with suspicion, as a possible vehicle for evil practices. That their suspicions are not entirely groundless is indicated by experiences cited by one engineer and two contracting firms. In defense of the estimating fee plan, contractors claim that it justly allocates the financial burden of submitting proposals, and that it benefits the construction buyer by lessening a huge economic loss occasioned by unrestrained bidding. The subject grows in scope and interest, and every engineer will find it profitable to study the opposing views. How far they bear on the attitude taken by this journal is left for later discussion.

Modern Water Rights

CLAIMS of abstract riparian right must yield to the principle of equitable apportionment in the important matter of interstate water supplies, according to the conclusions reached by the special master who has reported to the Supreme Court on the pending suit between New Jersey and New York regarding the use of the Delaware River. The decision not only solves the problem presented in the particular case at issue but in the long run is inescapable. That claims of a riparian landowner to the undiminished flow of a stream, even when this flow is at times harmful rather than beneficial, should constitute a perpetual bar to development for city water supply is inconceivable from the viewpoint of justice and equity. Material damage must not, of course, be inflicted without compensation; to insure this the master proposes modification of the original plan of development. As respects the abstract conception that common-law usage forbids any permanent diversion from a stream, however, he follows the precedent already established within the individual states by abandoning this confusing conception in favor of the doctrine of equitable apportionment. The verdict of the Supreme Court on this broadening of view as to water rights will be fundamentally important, the more so as the master's report in the Massachusetts-Connecticut case has already taken a similar view.

Negotiation vs. Litigation

COMPLETION of one of the many tedious steps necessary to secure a Supreme Court decision in the Delaware River case emphasizes the disadvantages of the method adopted to reach a solution. It is no disparagement to the necessarily complex procedure of our judicial system to note that, in the present case, a less expensive and much more expeditious settlement was available as the result of negotiation among the three states affected. Interstate treaties were twice drawn up and presented to the respective state governments, but legislative inertia and political conflict were allowed to prevent formal ratification in New Jersey and Pennsylvania. That both of these states must inevitably resort to the Delaware River for domestic water has long been self-evident. Because this necessity was not imminent, disagreements have been permitted to nullify all efforts to reach an equitable agreement. Now, at great expense, the arbitrary dictum of the law is to be substituted for the give and take of interstate cooperation.

Low Water

REPORTS of abnormally dry weather give notice that the 1930 drought is still with us and is piling up a growing shortage of water reserves. Lack of snow cover threatens agricultural prospects in the grain states. At the same time water supplies in various parts of the middle Atlantic and central regions are decreasing further, finding no replenishment from snow runoff or groundwater stores. The condition lays stress on the importance of the data given a week ago by the founder of streamflow study in the United States, Dr. F. H. Newell, in his compilation of available government data on the drought. Many months will be required to make up the deficiency of rainfall that has been building up since last February, and therefore water is likely to be a subject of concern throughout 1931. Precise and prompt knowledge of water facts would be particularly helpful in this conjuncture, but unfortunately these facts are imperfect and scattered; no one central agency collects and analyzes them. Water data are gathered by a number of uncorrelated bureaus in Washington, among them the Geological Survey, the Weather Bureau and the army Engineer Corps, so that a composite picture of the hydrological season can be pieced together only with difficulty and delay, as Dr. Newell found in making his compilation. A single office for water study is one of the reform needs of our governmental establishment.

Adding to Caisson History

ONE of the rare adventurous passages in the record of construction is at hand in the story of the Mid-Hudson bridge caisson that listed until it lay almost on its beam ends and then, in a year's steady salvage campaign, was slowly righted. Not least of the sensational points of the story is the overturning itself, a matter on which every foundation man will form his own opinion. Almost as sensational is the fact that the main span of the great suspension bridge had to be altered like a misfit garment because of the shift in position of the caisson. But the righting operation easily leads in interest. A 19,000-ton mass of unmanageable shape, wedged deep in

tough clay bottom and surrounded by sixty feet of water, offered a seemingly hopeless problem. Some twenty-five years ago a similar operation, of smaller dimensions, was carried out when a lighthouse foundation under construction in Chesapeake Bay tipped over. The methods used at Poughkeepsie resembled the former only in a general way, but as the engineer in charge of the earlier work, Charles F. Wood, was called as adviser to the contractor in the Mid-Hudson case it doubtless was of influence. The successful completion of the work is a credit to those who planned and executed it. But no engineer or contractor will want to face another such job. The year's delay and the great extra cost which resulted from the tipping are convincing arguments to prove that prevention is better than cure. Concrete caissons will undoubtedly be used in future. If their sinking requires greater care than other types of foundation work, such care is warranted, even if only to forestall the chance of another accident like that now recorded.

Earthquake Menace

NEWS of earthquake destruction is uncomfortably frequent. New Zealand's visitation last week came startingly close after the Oaxaca earthquake in Mexico, and both bring to mind vividly the destruction of several groups of Italian towns last year. Every new instance strengthens the case for extending earthquake study and seeking to learn the art of earthquake-resistant construction of buildings and community services. Neither subject has advanced beyond a primitive stage as yet. The work of scientific observers in making records of quake occurrence and phenomena has far to go before it can be of much help either in forecasting probabilities of occurrence or in providing the quantitative data on which protective measures can be based. Engineers are necessarily still farther behind, and have barely made a beginning in learning how to construct buildings, tunnels, bridges or pipe networks so that they will resist earthquake shock. Much work is already organized to promote study of these subjects. It deserves broad support. The interests of the populous regions included in the world's recognized earthquake belts are interwoven with our own interests. And, further, we have earthquake possibilities of our own.

Threadbare Cant

GRAIN exports are nearing their end, says the head of the farm board. Other countries are increasing their grain production and are making rapid progress toward the point of replacing the supply heretofore drawn from the United States. This charge, evidence of which can be seen plainly in the grain market troubles of the last two or three years, removes all remaining support of the always questionable grain-freight argument for a St. Lawrence waterway for ocean vessels. Yet even current writings on St. Lawrence development still bring forward the old agricultural claims and sometimes, indeed, gravely characterize the waterway scheme as a farm-relief project! This is the language of tradition, heard decades ago from promoters of canals to connect the lakes with the Mississippi, and in later years heard time and again in other canal or river discussions. Those who continue to use it as convenient hokum to support canalization claims betray a sad lack of imagination. It is time they dropped the threadbare cant of early days. With thought and ingenuity they could place their argument on more solid ground. Both farm relief and waterway construction have merit, but they have no relation to each other.

Studying Distribution

INDUSTRIAL association activity, as revealed in meetings of the past few months, is directing itself almost wholly toward sales, marketing and price problems. Efficient distribution of product to consumer has become the most immediate objective of industry co-operation. This represents an important realignment of thought. Heretofore industrial associations have concerned themselves with many things, the competition of rival industries among them, but normally have not worked intensively on developing the maximum maker-to-user efficiency within their own field. The change meets an important need of industrial growth, for a number of the industries that serve construction are far weaker in their distribution mechanism than in their production. To remove all obstacles to free flow of product from point of manufacture to ultimate use is one of the essential joint tasks of industry, and therefore should be a major part of the industrial association's work. That the pressure of the past year has greatly increased attention to market development and distribution is therefore a constructive development. It will not lead to reduction of technological improvement and research; rather to an increase, since thorough correlation of product with use is the objective. Distribution, a necessary aid to this correlation, has been too much left to the care of the individual producer. It is a joint industry problem.

A Research Lesson

THE roadbuilder's defense against frost action is substantially strengthened by the information given in the two leading articles in this issue. The article by Burton and Benkelman of Michigan is primarily an account of research, secondarily a record of the application of its lessons to subgrade construction; that by Motl of Minnesota considers research only as it provides a basis of principle for working out a specific method of frost-resisting subgrade construction. Both articles are excellent examples of fundamental research directed to practical purposes.

Since the beginning of wagon trails, highway builders have been accepting the action of the elements as dispensations to be endured and their damages to be recovered from as best they could be. Destructive frost action in particular was regarded as inevitable. Each year the "spring breakup" was looked forward to with no further hope than that it might be less costly than it was quite possible it might be. Such preventive caution as was exercised was much of the species that locks the barn door after the horse is stolen, and then uses as a lock the first device that comes to hand. The frost boil was temporarily drained or plugged; the frost-heave was aided to settle as fast as possible. Elimination of the cause, when undertaken, was wholly an empirical process and its success was commonly accidental. Causes were not known; nothing more was known than that the phenomena occurred.

With greater investment in road surfacing and sharper demands for uninterrupted year-round travel service, this accustomed situation grew unendurable and search

for cures began. At first tentative and later more purposeful field work was undertaken to cure specific cases; this was a period of cut-and-try methods. Then with attention to soil physics encouraged by Terzaghi, by engineers of the Bureau of Public Roads and by other investigators, the search turned to fundamentals. Prof. Taber at the University of South Carolina, and workers at Michigan State College and the University of Michigan, as well as the Michigan highway department, devoted study to the problem. The result was the disclosure of principles of frost action that could be converted into working hypotheses for remedial construction.

The warrant for this explanatory outline of frost experience and study is that it demonstrates the line of attack that promises relief from most of the troubles experienced by the roadbuilder from the action of the elements. Snowfall and drifting, that other most serious winter trouble of the highway engineer, is quite as susceptible of analysis and translation into working hypotheses as frost action. Indeed, the Michigan highway engineers have already taken a long step in this direction. No one can imagine that present research has told all the story of frost phenomena in highway subgrades, but the completed chapters have been wholly worth while even if the narrative were never to be penned. The fact that the hidden action of frost in soils can be spread open to view on the roadbuilder's desk indicates that he may learn through field and laboratory research how the snowdrift comes to settle on his road, and therefrom devise measures to prevent the blockade.

The present articles on frost action on highways are not significant only for the practical aid they give the road official; they describe the power of fundamental research to forge the tools that will enable the soil, the frost and the windblown snow to be worked and constrained to the service of public roads transportation. There is a worldwide opportunity in highway engineering and administration for constructive research imagination to plan and coordinate fundamental investigations; it is a proper task of roadbuilders' associations to do this. The highway administrator and road user is speculating today just as vaguely about road programs, finance, tax distribution, traffic needs and safety, and other questions which directed research can elucidate, as ever was the constructor about frost action.

Government Functions?

LAST year the department of commerce drafted and sent out to engineers concerned in city planning a tentative model regulation to govern subdivision platting. Now the same department proposes to draft another model regulation, dealing with the underground location of utility conduits. Both measures directly affect city life. They deal with local matters, matters of such character that regulatory action is effective only if adapted closely to local needs and conditions. What is the effect of action by the national government in this field?

Respecting the subdivision regulations already circulated it should be said that any Washington prescription of street widths will have no influence or value in suburban Chicago, the outskirts of Richmond, or the residential areas of Los Angeles; these cities already have set up safeguards against street platting of the kind known in horse-and-buggy days, when narrow streets and dead ends were common. But it may affect practice in communities that have little or no regulation, and its probable effect here is important to consider. Will it serve to limit the cupidity of subdividers and assure future generations the spaciousness to which they are entitled and which they will demand? Unfortunately, no. The model regulation establishes widths much narrower than usual in many cities, and if, backed by its government stamp, it obtains currency it may do definite harm. It is likely to foster the laying down of too narrow streets, and would do disservice to the municipal engineer who attempts to look ahead in his planning, for even now he has a hard time persuading subdivision owners to dedicate enough street area.

So much for the street-width element of the model regulation. Regulation of other features, such as alley width, length of block, size of lot and related dimensional factors, is even more obviously out of the sphere of the national government because so much depends on local conditions—type of community, topography, and character of development.

Related considerations apply to the present proposal to deal with the allocation of subsurface street space for utilities. The question is timely, since utility systems are spreading rapidly into country areas, ahead of street surfacing. Well-studied allocation is desirable, just as street-width control is desirable, but it is inherently a local matter, suited perhaps to state action but not to action by the federal government. State highway departments already have issued regulations on street and road space allocation. Any proposal to vest such control in the United States, or even the mere issuance of a model regulation carrying government prestige and authority, would be as questionable as the establishment of a national standard for street widths. Local acceptance of any such model is likely to be blind and undiscriminating, giving no thought to how well the model fits local conditions. On the other hand, the existence of the model tends to make difficult the establishment of a different local regulation.

There is also another consideration. Technical societies are active in the study of variations in practice and the preparation of general guide standards. They have developed effective machinery for the purpose, and their work enjoys countrywide recognition. An A.S.T.M. specification for steel, an A.S.M.I. pavement or sewer specification, an A.W.W.A. pipe specification, is accepted the country over, and bears the warranty of painstaking care in preparation and due regard for the interests of the several parties concerned as well as of local variations. The American Society of Civil Engineers has now under way an elaborate investigation of best practice in subdivision platting and underground street structures; it will lead to a statement of fundamental principles from which codes may be developed to suit specific local needs. This is eminently proper work for technical societies. Is it proper for the government to enter into this domain?

In sum, on the score of serviceableness there is little to be said for these excursions of the national government into the field of municipal development. On the score of necessity little more can be said, for existing independent agencies are at work on the study of varying practice and the development of guide standards. One may fittingly ask, therefore, whether the government is not injecting itself into matters which are outside its concerns, and whether the case is not another example of the tendency of Washington to adopt a great-white-father attitude toward the country.

FROST IN ROAD SUBGRADES

Two articles describing practical application of research data to prevent surface heaving and frost boils

Frost Action in Silt Soils Defined by Field and Cold-Room Studies

By V. R. BURTON and A. C. BENKELMAN

Deputy Commissioner and Research Engineer, Michigan Highway Department, Lansing, Mich.

FROST HEAVES, which every year for innumerable years past have destroyed pavements and made unpaved roads impassable, are in a fair way to complete cure through research by highway engineers and soil experts. Among the active investigators very great credit must be given to the state highway department of Michigan for its long-pursued and thoroughgoing search for causes that would submit to practicable means of correction. The article which follows outlines the work done and the use being made of the results. It is condensed from a report made to the highway research board at its annual meeting last December. —EDITOR.

FAILURE of pavement due to subgrade is wholly a phenomenon of soil movement either vertically or laterally, or both. This statement is subject to only minor exceptions. Vertical movement in Michigan comes from two major sources, namely, from the plastic flow of soils either in or beneath the subgrade and from expansion due to frost action. The most important soil movement is caused by frost action, resulting in damage to pavement from rupture, due to differential expansion of subgrades on freezing, and from settlement subsequent to thawing. This class of damage accounts for over 50 per cent of pavement the condition of which is classed as unsatisfactory; pavement is considered unsatisfactory when the size of developed pieces is less than 10 sq.yd. The total percentage or yardage which can be classed as unsatisfactory increases with age; percentages vary from 1.5 per cent the first year to 2.9 per cent at two years, 4.5 per cent at three years, 5.3 per cent at four years and 6.5 per cent at five years.

Field Study Undertaken

During the winter of 1928-29 frost heaving was unusually severe. In February, 1929, field engineers of the department were requested to secure certain information on the location and extent of all the major disturbances. The exact limits of each heave were staked out in the field, and the location as staked was shown on maps forwarded to the main office, so that the heaves might be easily located for future study. The approximate height of each heave above the general profile was determined with a hand level.

More than 500 heaves were located in this preliminary survey, and during the following two summers detailed examinations were made of about 150 of these. Field examinations of the soil were made by trained men, who investigated not only the soil itself but prepared sketches which showed the condition of the road surface, grade of the road, depth of cut, direction of surface drainage and all other factors which were considered to have any bearing on the problem.

Important Results of Field Study

It is quite definitely indicated from the information disclosed by the field studies that: (1) a layer or pocket of fine-textured material surrounded by a coarser, better-drained soil is a condition favorable to frost heaves; (2) where a relatively small area of silt or very fine sand outcrops in a loam or clay soil, trouble from frost heaving is very apt to develop. It is definitely indicated that: (1) Heaves are very likely to develop in medium to fairly coarse sands when the water table is abnormally high or where an underlying impervious clay layer cuts off the downward movement of gravitational water; (2) heaves may occur where water is fed under pressure to moderately coarse soil textures.

A detailed analysis of the cause and effects of the 156 heaves examined in the field showed that 94 occurred in a layer or pocket of fine-textured material such as silt, very fine sand and silt, silty clay, clay or sandy clay surrounded by coarser better-drained material; 22 occurred in a pocket of silt or very fine sand and silt surrounded by clay; 30 occurred in medium to fairly coarse sand; and six occurred in moderately coarse textures. The remaining four of the 156 heaves occurred where the subgrade soil appeared uniform with respect to character and moisture content.

Of the 94 heaves which occurred in finely divided soils, study showed that 5.3 per cent developed in silt, 32 per cent in very fine sand and silt, 4.3 per cent in very fine sand, 30 per cent in clay, 8 per cent in silty clay and about 17 per cent in sandy clay. For the 22 heaves which occurred in finely divided textures surrounded by clay 45 per cent developed in silt, 23 per cent in very fine sand and silt, 18 per cent in silt clay and 14 per cent in sandy clay. These studies showed that the average length of deposit of these finely divided textures was somewhat less than 60 ft.

The upheaval was greater where silt was involved

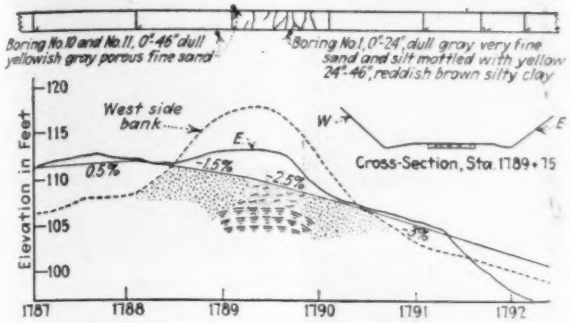

Fig. 1—Heave due to frost action in very fine sand and silt

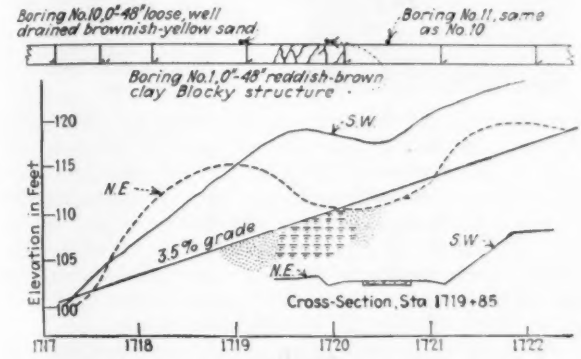

Fig. 2—Heave due to frost action in clay pocket

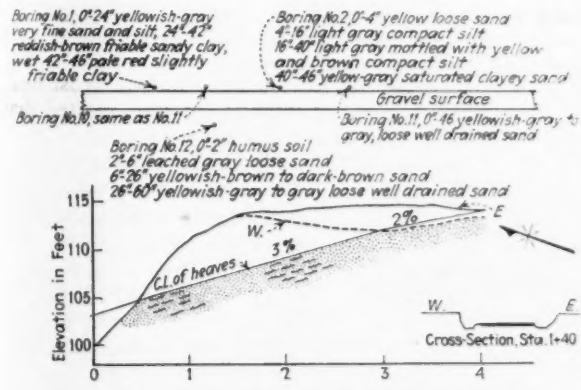

Fig. 3—Two typical frost heaves in gravel road in cut

The height was somewhat less for sandy clays or loams than for clays. The average height for all the heaves occurring in silt was 6 in.; in very fine sand and silt, 5 in.; in very fine sand, 4 in.; in clay, 4 in.; in silty clay, 5 in.; and in sandy clay, 3 in.

Of the heaves 80 per cent occurred in cuts, 2 per cent on fills, and 18 per cent on locations extending from cut to fills. For the 500 heaves located in the preliminary survey 76 per cent occurred in cuts, 10 per cent on fills and 14 per cent on cut-to-fill locations. For the 141 heaves studied in cuts 80 per cent were located at a depth of 4 ft. or more from the original groundline elevation.

Figs. 1, 2 and 3 show plans and longitudinal profiles of several typical frost heaves. In Fig. 1 a pavement slab laid directly upon a pocket of very fine sand and silt underlain by clay and surrounded by well-drained sand is badly cracked. In Fig. 2 a slab laid on a pocket of reddish-brown clay surrounded by well-drained sand is likewise badly cracked. Fig. 3 shows a cut where two distinct abrupt heaves developed in a gravel road surface. At the point of each disturbance the subgrade consists of very fine sand and silt. A well-drained sand prevails throughout the remainder of this cut.

Conclusions from Field Study

The knowledge gained from the studies suggests the possibility, on new work, of locating in the great majority of cases associations and conditions of soil textures which cause excessive frost disturbances. This applies particularly to silt textures. Invariably this grade of soil exists, unless manipulated, in a wet although stable condition, even during periods of drought. Furthermore, information obtained from 200 miles of general soil work in 1930 shows definitely that trouble from frost action unquestionably occurs wherever this grade of soil prevails. On the other hand, it was found that excessive heaving does not always occur in clay or sandy-clay pockets, even when surrounded by sand—an association of disastrous implication where silt is involved. If clay or sandy-clay pockets are quite far removed from sources of water, the chances are that no serious trouble from frost action will occur.

Laboratory Soil-Freezing Studies

In 1928, in order to study the phenomena of frost heaving, a cold room, 9x12 ft. in size, was built in the state highway department laboratory at the University of Michigan, in cooperation with the civil engineering department of the university. Temperatures in this room are controlled automatically, so that it is possible to maintain a temperature within about 2 deg. between the limits of 0 to —35 deg. C.

The initial freezing experiments were conducted on undisturbed specimens of soil 3 ft. long and 1 ft. in diameter, obtained by forcing a split cylinder of steel into the soil by a hydraulic jack and superimposed truck load. At the laboratory the specimens were placed in split-cylinder wood containers of the same diameter. The sample rested on a layer of gravel in a metal pan, which in turn was supported by a metal drum through which water at any desired constant temperature could be circulated. Water could also be circulated through the gravel layer on which the test specimen rested. The wood containers were then placed in rectangular boxes and the intervening space filled with sawdust. Thermocouples were installed at different points in the soil specimens, and samples of the soil were also obtained for physical analysis and moisture-content determinations. The specimens were frozen in sets of two, one containing an inserted porous layer of material at its midpoint. Freezing took place gradually from the top down, periodic measurements of the temperature being obtained by means of the thermocouples.

Large Specimen Tests—The first two specimens consisted of an almost uniform silt taken from a location (Fig. 4) where an exceptionally bad heave had occurred. They were frozen first without access to additional water, then thawed and refrozen with water circulating through the sandy-gravel layer at the base of the specimens.

The moisture content of the silt prior to the first freezing was about 16 per cent. No heaving or expansion occurred in the first freezing. On the second freez-

ing, with the introduction of water to the bottom, 0.74 in. uplift occurred in the case of the column without the gravel cutoff, and 0.46 in. in the case of the column containing the gravel layer. On removal and examination of the specimens it was found that the uplift was apparently due both to a general expansion of the material on freezing and to a very minute form of segregation.

The interesting phenomenon was noted that the individual pieces of gravel composing the cutoff had settled into the silt beneath, a movement which evidently occurred when the specimen was thawed after the initial freezing. Some of the pieces were 1 ft. beneath their original position (Fig. 5). This serves as an explanation of loss of metal from gravel and macadam road surfaces. The moisture gain of the silt was about 16 per cent, except for the portion above the gravel layer, which was about 9 per cent.

The fact that segregation of water into ice plates of appreciable thickness occurred every winter at the location where these samples were obtained and not in the laboratory tests led to the opinion that natural conditions in the field were not reproduced in the laboratory. This particular frost heave had been the subject of considerable investigation previous to the laboratory tests. Attempts had been made, without visible success, to correct the condition by an extensive system of lateral tile drains and transverse bleeders. Also, an excavation along the edge of the pavement had been made when the subgrade was frozen, and a sketch prepared showing the developed ice plates in the soil profile. This is reproduced in Fig. 4 The total uplift at this point was approximately 10 in.

Another pair of specimens taken from a second silt heave were first given access to water from below until the specimen not containing the gravel layer became moist on top. The results, in so far as heaving was concerned, were almost negative, although examination of the frozen specimens did reveal evidence of slight segregation in a 4-in. silty-clay layer existing at a depth of 6 in. below the top of the two soil columns. It was slightly more pronounced in the specimen not containing the gravel layer. The silty-clay material analyzed about 35 per cent clay, 45 per cent silt and 20 per cent fine sand. The moisture content of this material after test was 82 per cent—representing a gain of approximately 50 per cent in the specimen without the gravel cutoff, and 30 per cent, or a gain of about 10 per cent, for the other. These specimens were then gradually thawed and later refrozen. On the refreeze no additional expansion of or segregation in the material was noted.

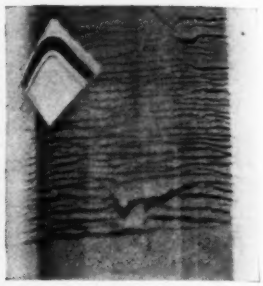

Fig. 5 (Left)—Frozen silt cylinder with gravel cutoff; hoar frost formed in void space created by settlement of gravel into the wet soft material Fig. 6 (Above) — Graded frozen silt, showing segregation in material finer than 0.005 mm.

The purpose of introducing a layer of porous material was to determine if water in a vapor form is transferred through a material with a large void space when freezing takes place above. This unquestionably occurred in the case of the two specimens frozen. The moisture-content increase in the silt above the porous layer in both cases, as previously noted, was about 10 per cent. It was observed, moreover, on examination of the specimens after test that the voids in the gravel were almost entirely filled with hoar frost (Fig. 5).

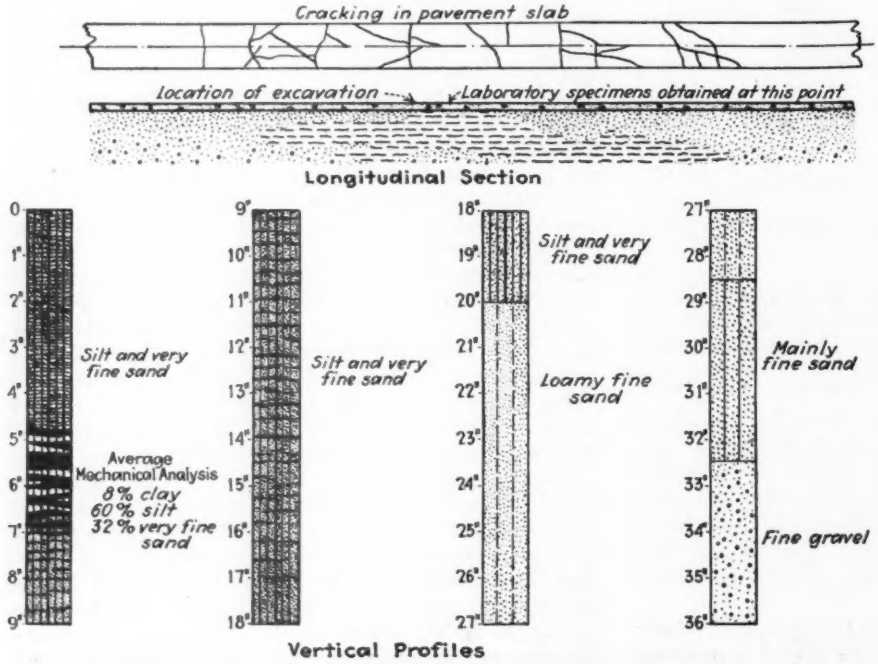

Fig. 4—Sections of frozen subgrade, showing presence of ice layers

Glass-Tube Tests—A series of specimens was prepared by dispersing a definite quantity of silt and permitting the material to settle out into glass tubes 8 in. high and 65 mm. in diameter. This gave a graded specimen, the coarser particles at the bottom and the finer at the top of the tube. Other samples were prepared by tamping the material into tubes and setting them upright in water until the soil at the top became moist.

In the specimens prepared by dispersion and deposition it was found that ice plates invariably developed in the upper part of the tube or in that portion of the material having a particle-diameter size less than 0.005 mm. (Fig. 6). Only microscopic segregation occurred in the silt specimens prepared in other ways. However, after a series of the latter was

frozen, several were thawed from the bottom up, and a break or void in the soil followed the thawing line, which gradually increased in width as the thawing line progressed upward. This void filled with water, and on refreezing, before the thawing line had reached the top of the specimen, this water was converted into a pure ice layer.

A second ice layer was later developed below the first in a similar manner (Fig. 7). As the thawing line progressed upward the individual silt particles were released from the frozen mass above and could be seen settling down through the clear-water layer to the unfrozen soil beneath.

In nature the depth of frost penetration is more than likely a decided variable, depending upon local variations in soil character and texture, amount of moisture present in the soil, etc. Fluctuations of the air temperature in turn promotes thawing to unequal degrees beneath the surface, which in all probability results in a very irregular vertical profile of the thawing or freezing line. When soils freeze, expansion takes place in proportion to the amount of water present. If thawing then occurs from underneath, the frozen material will suffer a decrease in volume in proportion to the amount of expansion that has occurred, and voids of variable dimensions and variable distances from the ground surface may develop. Water liberated fills the voids and then freezes at subsequent downward movements of the frost line. A number of repetitions of this phenomenon could easily cause excessive heaving.

The majority of silts in which frost disturbances have occurred under roads in Michigan contain from 10 to 20 per cent clay, 60 to 80 per cent silt and 20 to 30 per cent fine sand; or on an average, 70 per cent of such textures has a size range from 0.005 to 0.10 mm. The theory of alternate freezings and thawings of the ground below the surface and the resulting formation of ice layers as offered above serve as an explanation of the excessive disturbances that occur in materials having a particle-diameter size larger than 0.005 mm.

No difficulty has been experienced in promoting the formation of ice plates in clays and silty-loam soils, a few specimens of which were frozen simultaneously with the silt specimens. Marked segregation invariably took place in these materials regardless of the rate of freezing, method of preparation of the specimens or the type or size of the containers.

Practical Application of Results—Starting in 1930, preconstruction soil surveys were made on all pavement projects. The road line is examined by a soil surveyor immediately after the construction survey is made, and all soil types are shown on the plan when it is drawn up. Construction features involved in grade design, methods of drainage, subgrade treatment, etc., are considered in their relations to this soil information, and plans are drawn accordingly. Due to the detailed study of soil formations necessary to locate areas liable to frost heaving, it is necessary for the soil men to visit the jobs from time to time during the course of grading and inspect the subgrade carefully when it is exposed to view. Subgrade treatment and drainage measures previously recommended are reviewed and checked, and any changes deemed necessary from the information disclosed by the detailed study are ordered and made.

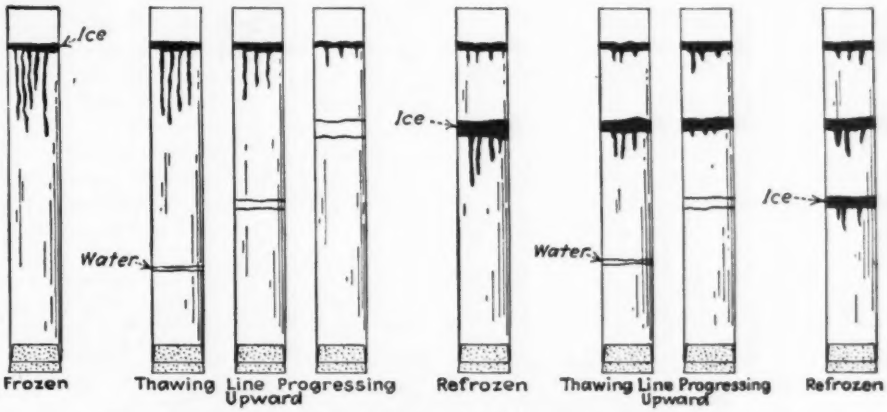

Fig. 7—Development of ice layers in silt by alternate freezing and thawing

Silt pockets, wet-clay areas, saturated sand layers over clay and areas affected by seepage are definitely located; and then measures are applied for the purpose of eliminating or reducing frost heaving. Inasmuch as little doubt exists concerning the invariable tendency of heaving in silts, silty clays and very fine sands, these materials are generally removed from the grade and replaced with a proper material. The depth of excavation in the work done to date has been varied in some cases as a matter of experimentation, although this now is governed largely by the location in the state, north or south, and the length of deposit.

In a few instances where unusually long deposits of these textures were encountered it was found more economical to raise the pavement grade than to excavate and replace the material with a satisfactory grade of soil. Inasmuch as most of these undesirable textures prevail in the subsoil of sandy moraines, it is simply a question of wasting the excavated material and using the surface soil for backfilling purposes. In some instances tile drains were installed, in addition to removal and replacement of the material. This added precaution was taken in the cases where silt or very fine sand pockets were surrounded by clay, and coarser material was used to replace the objectionable type of soil.

In the case of pockets of wet-clay areas surrounded by well-drained sand or layers of wet sand over clay, steps are taken to intercept possible sources of lateral seepage water and to lower the groundwater level by systems of tile drainage. In view of the lack of definite information obtained in the field studies concerning the occurrence of post heaves in clay, the removal of this type

of soil and the substitution of an unquestionable material does not yet seem to be justified.

In all, about 200 questionable locations in the grade of new paving projects were accorded some form of special treatment during the construction season of 1930. Special drainage structures were installed at approximately 125 of these locations, while in most of the other cases the material in question was removed and replaced with a suitable soil. Detailed records, of course, have been kept as to the nature of the corrective measures applied to each particular location in question, and it is anticipated that within the space of a few years interesting and useful information will be forthcoming from this work.

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Curing Minnesota Frost Boils by Drains

By C. L. MOTL

Assistant Maintenance Engineer, Minnesota Department of Highways

MUCH has been said and written in recent years on the subject of frost boils, but very few of the opinions and theories so advanced are based on demonstrable facts. Moreover, the opinions held by any single individual have been subject to constant revision as experience matured and engineering data became available. The Minnesota department of highways has been studying this problem for a number of years and numerous methods of overcoming the trouble have been tried. At present several types of frost boil cures are being used, all of which are giving relief.

Frost boil in action

The term "frost boil" as commonly used is applied to a manifestation of road-surface behavior brought about by certain frost and soil conditions in the subgrade, which cause the road surface to weaken and break up during the spring. Frost boil is often confused with frost heaving, since subgrade heaving during the winter usually precedes the boil in the spring. Often, however, no boils will occur over serious heaves on account of adequate natural subdrainage, as will be explained later. In Minnesota both the "boil" and the "heave" are being studied and treated—the first to overcome destructive effects on light-type surfaced roads, and the second to lessen the destructive effects on pavement where the action is of a differential nature.

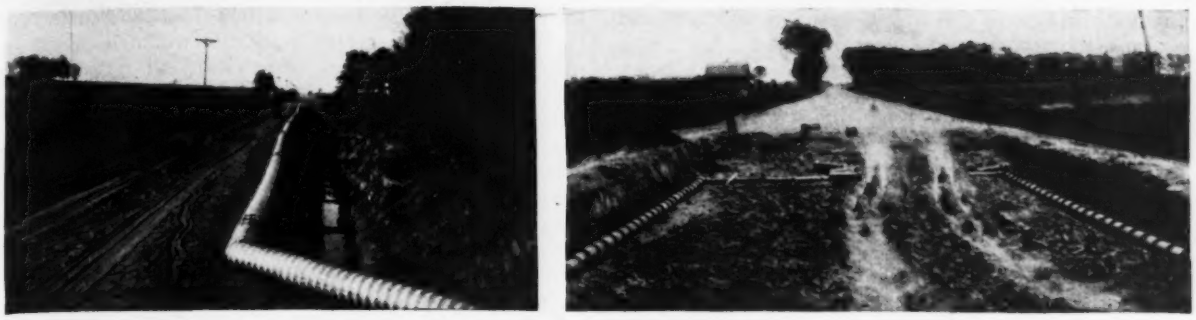
Conditions contributing to the cause of these phenomena may be divided into primary and secondary classes: Primary conditions, which will cause frost damage wherever and whenever they exist, are: (1) an ample supply of moisture due to a high groundwater table, side-hill seepage, land-locked pockets in fills, or underground streams; (2) a fine-grained, retentive soil with great capillary moisture capacity; (3) the prevalence of low temperatures for considerable periods of time.

Secondary conditions, which aggravate the trouble, are: (1) unusual height or depth of cuts and fills, incident to modern grading practice; (2) keeping roads open throughout the winter by organized snow-removal programs; (3) large volume of traffic including many heavy vehicles; (4) warm spring rains, which temporarily make matters worse but eventually accelerate penetration through the frost zone. Engineers who have given thought to the subject have slowly evolved a theory which satisfactorily explains the action of a typical frost boil and now find themselves approaching agreement so far as the basic cause is concerned. According to this theory a typical behavior cycle may be roughly described as follows:

At the time when freezing begins in the fall, capillary movement of water is speeded up (this has been demonstrated by laboratory experiments) and the flow is toward the areas being frozen. Where the soil is of high capillarity (very fine grained), water will be drawn from depths of more than 10 ft. and the movement toward the freezing surface will be continuous. For reasons not entirely explainable, the water on reaching the frost zone freezes in small masses, mostly interrupted horizontal layers, of varying sizes and dimensions, forcing the soil upward to make room for itself. As the frost penetrates downward, the ice masses continue to form at about the lower surface of the frost zone. The action is continuous as long as the frost continues to penetrate and the supply of underground water is adequate.

Where such action occurs, a large volume of excess water in the form of ice accumulates in the road subgrade during the winter, the volume being about equal to the heave of the road surface. The existence of this ice has been amply verified by numerous borings made on Minnesota highways in winter. The depth to which frost will penetrate is influenced by the amount and kind of surface protection. Modern highway practice tends to produce a lower frost line under the traveled roadway than under the shoulders and side slopes.

The same factors that are responsible for deeper frost penetration under the roadway also cause thawing to begin there first and likewise proceed there at a more



Two methods of curing frost boils

Left—Typical cure being installed on a trunk highway with bottom perforated pipe. Right—Two lines of tile pipe are used under pavements.

rapid rate than under the shoulders, where the subsoil is usually protected by sod and grass, or even by snow. The thawing of the ice layers in the soil produces an excessive amount of free water, which naturally follows the frost-table surface to the low areas, and these are along or near the center of the roadway. During the early stages of frost recession free water may boil up through small crevices in the surface crust of the upheaval. On gravel or earth roads this crust is quickly disintegrated and churned into mud at a time when the thaw line is only a few inches below the surface. As thawing penetrates deeper and surface evaporation becomes more rapid, another crust is soon formed with a zone of imprisoned water underneath between it and the receding sublayer of frost. During the time required for the frost zone to be penetrated and vertical drainage established, an extremely critical and unstable situation is created.

What happens during this critical period of several weeks' duration is purely adventitious. If load restrictions are imposed, it may be that the crust will increase in thickness rapidly enough to prevent the lighter vehicles breaking through. More often, however, a rupture will occur in spite of all precautions, and once this has happened an impassable quagmire quickly results. Recourse must then be had to heavy planks or to some other temporary expedient to carry traffic. As a rule the initial break occurs regularly every spring in approximately the same location (usually in cuts), but it is evident that this need not invariably be true.

The remedy to be applied depends first of all upon the objective purpose. Under pavement slabs, where heave elimination is primary while subgrade soil-bearing value is secondary, the remedy being used so far in Minnesota is to excavate the areas and backfill with low-capillarity material, providing also drainage outlets. Under light surfaces, such as gravel, where spring break-ups are very damaging, any cure that will preserve the surface and carry traffic is all that is needed. What is desired is some method that will do this safely, assuredly and economically.

Generally it will be advisable to wait until frost boils have actually developed before deciding where to apply remedial measures, as it is practically impossible to predict with assurance the exact location of the most critical combination of causative factors. This does not mean that complete data derived from reconnaissance, surveys, soil borings and other sources should be slighted or not utilized in fitting each design to its requisite set of conditions.

As stated heretofore, several types of frost-boil cures are being used in Minnesota, all of which include the general principle of excavating and backfilling with porous material a longitudinal trench along the center line of the roadway, with outlets leading to free openings. In some cases the trenches are provided with longitudinal subdrainage, with frequent side outlets, while in other cases subdrains are used only at the outlets. The designs vary in top width of trench from 22 ft. to only 2½ ft., while the extreme depth is kept at from 2½ to 3 ft. Briefly described, the various types can be grouped about as follows: (*a*) longitudinal center line trench 2½ to 3 ft. wide and 2½ to 3 ft. deep, backfilled with porous material and having outlet trenches at suitable intervals; (*b*) same as (*a*) except that longitudinal and outlet tile or pipe drains are used near bottom of trench; (*c*) longitudinal center line V-trench 10 to 20 ft. wide on top and 2½ to 3 ft. deep at center, backfilled with porous material and having outlet drains at low points of profile; (*d*) same as (*c*) except provided with open subdrains as in (*b*); (*e*) longitudinal flat trench 22 ft. wide on top, 2½ ft. deep at the sides and 2 ft. deep along the center line, provided with side tile longitudinal drains and metal pipe outlets. It will be noted that these vary from special drainage structures of light design through types of subgrade reinforcement to massive combinations of both. Some of these types are very expensive to construct even under the most favorable conditions.

Perforated Pipe Found Effective

In many places in Minnesota the cost of porous material, such as sand and gravel, is so high that some type of cure using small quantities had to be developed. This brought up the question of unreliability of the usual tile drain, many failures of which have been experienced in Minnesota.

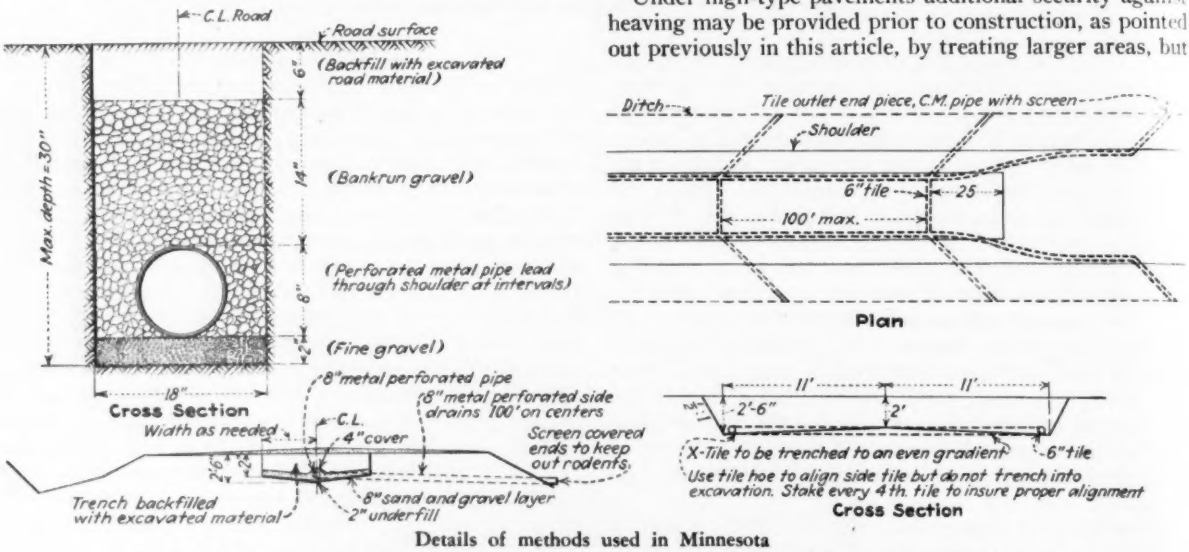
For some time past the growing problem of frost boils, with increasing traffic, led some highway engineers to embrace almost any type of cure offered, and among them the perforated corrugated metal pipe appeared. The first scattered installations of these were undoubtedly the result of good salesmanship rather than of sound engineering deductions. The pipes were installed with perforations downward and at shallow depths of about 2 ft. to the top of the pipe. The most surprising development was that the plan worked and no plausible explanation could be given. This called attention to the possibilities of using shallow-type open-drain installations, which previously had failed where tile and similar structures were used.

About this time the corrugated metal pipe industry began to talke an interest in the frost-boil problem and a

number of excellent and highly qualified engineers were placed in the field to assemble all the data available, make investigations and establish contacts with highway departments. This was particularly true of the Armco Culvert Manufacturers Association.

Results in Practice

On trunk highway 59, a graveled road, where gravel costs were high and frost-boil trouble extensive, it was decided to use perforated metal pipe in a few experimental installations. The installations were made in the fall of 1929; the condition of the treated sections in the spring of 1930 showed successful results throughout. The average total cost of these installations was about



Details of methods used in Minnesota

Left, above—Narrow trench method. Left, below—Wide intercepting gravel layer and perforated pipe. Right—Massive type of tile drain for use under pavements.

$1.40 per linear foot. Indications are that with suitable equipment and trained crews the cost could be reduced.

While frost penetration in Minnesota reaches a depth of over 5 ft. in most places, a drain depth of 30 in. was chosen for the following reasons:

1. The observed depth of thawed surface at which frost boil trouble was most serious and critical was about 2 ft.

2. A greater depth of installation would materially increase the cost of excavation and backfill.

3. Outlets exposed to the open air are preferable to deep tile connections, and these may be secured readily and with a minimum length of pipe if the depth is held to 30 in.

4. The additional time required for thaw to penetrate to a deep drain, as compared with a shallow one, may be a measure of the difference between failure and success. Whatever frost might form in the porous backfill column would be removed much more quickly by heat from above and circulating air from below for a 30-in. column than for a deeper one.

5. Acceleration of thawing along the center of the roadway increases the slope of the frost-table surface toward the drain; this in turn hastens the movement of free water in that direction.

6. Tile drains laid at depths of from 42 to 54 in. in herringbone arrangement and under coarse gravel backfills had been found unsuccessful in many locations. The failures may, of course, have been due to other factors than depth, but depth undoubtedly had some influence.

The action of a center line drain would be about as follows: During the summer and fall, gravitational water that collects under the road surface adjacent to the drain will pass into the open gravel and be removed through the pipe. Since very little or no gravitational water is present at the time of freezing temperatures, ice formation will be delayed until such time as the temperature falls well below freezing. This fact will eliminate or greatly retard the phenomenon of ice segregation which takes place in the upper layers of the soil and which is responsible for heaving and for cumulative lift of large quantities of capillary water along and near the center of the roadway.

Under high-type pavements additional security against heaving may be provided prior to construction, as pointed out previously in this article, by treating larger areas, but it may be that the center drain alone, with its porous column of gravel, will reduce differential heaving to a permissible amount.

Where conditions are particularly severe and the narrow trench might not be sufficiently effective, a modified design is being developed, consisting of a wide trench, 2½ ft. deep, filled over the bottom with a uniform layer of 8 in. of sand and gravel and provided with a longitudinal metal pipe drain. The rest of the trench is then backfilled with the excavated material. It is expected that the layer of gravel will intercept all capillary water and lead free water to the open pipe drain. As a result, accumulation of excess water and all heaving in the overlying soil will be prevented and the soil will remain stable at all times.

Metal pipe is advantageous to use for this work on unpaved roads because its strength, flexibility and positive joint connections enable it to maintain true alignment and structural integrity at shallow depth, regardless of differential frost heaving or possibility of load impacts from above. Also it is foolproof and experience shows that it can be easily installed by average workmen.

For a description of other methods of treating frost boils in Minnesota, the reader is referred to a discussion by F. C. Lang, engineer of tests and inspections, Minnesota department of highways, which appears in the 1930 convention *Proceedings* of the American Road Builders' Association, pp. 508-519; also, *Public Works*, January, 1928, "Frost Boils and Their Elimination."

New Formula for Friction Losses in Steel Pipe

All available data from steel pipe experiments used as basis—Roughness coefficient for full-riveted pipes depends on plate thickness

A NEW formula for calculating friction losses in steel pipe lines carrying water under pressure is presented by Fred C. Scobey, senior irrigation engineer, Bureau of Public Roads, in Technical Bulletin 150, published by the U. S. Department of Agriculture. The new formula is based upon experiments conducted by the Department of Agriculture and upon all the available data from experiments made in the past on steel lines. A study of these data yields the expression $H = K_s \frac{V^{1.9}}{D^{1.1}}$, where H is loss of head due to friction, in feet per thousand; K_s is a coefficient dependent upon the pipe characteristics, such as plate thickness, type of jointing and age; V is average velocity of water, in feet per second, and D is average diameter of pipe in feet.

Scope of Experiments—The experiments upon which this expression is based were made upon 198 reaches of pipe, including 1,178 observations, and include data taken as early as 1850 and as late as 1929. All the pipes tested were coated with bituminous material, but varied in age from new to 47 years old. Sizes as small as 4 in. and as large as 168 in. in diameter, carrying quantities as low as 0.89 sec.-ft. and as high as 982 sec.-ft., were included. Velocities ranged from 0.65 ft. per second to 22.9 ft. per second.

Pipes were grouped in three classes, depending upon the type of jointing: full-riveted, in which both longitudinal and girth joints were riveted; girth-riveted, in which longitudinal joints were made in such manner as to avoid obstruction to the interior; and continuous interior, in which no obstruction at all was presented to the flow.

Method of Experimentation—In those experiments performed by the department of agriculture, velocities were measured directly by timing the passage of a cloud of color solution injected into the pipe line. Inside diameters were measured directly where such a procedure was possible; in other cases the external circumferences were measured and the known plate thickness was deducted from the external diameter. Nominal diameters were accepted where it was impracticable to obtain more accurate data. Friction losses were determined from observations made on piezometer tubes inserted in the pipe at the ends of the reach being tested.

Coefficients—In the formula resulting from an analysis of the data, the effects of varying degrees of roughness of interior and of varying water temperatures are included in the evaluation of the coefficient K_s. The law of variation of this coefficient with the age of the pipe can be expressed as $K_s = K'_s e^{0.015t}$ for aggressive or rapidly corrosive waters and $K_s = K'_s e^{0.01t}$ for non-aggressive waters, where K'_s is the coefficient for new pipe, e is the base of natural logarithms (2.718), and t is the age of pipe in years.

In order to determine suitable values for these coefficients, steel pipes are divided into three major classes, which are:

Class 1, *full-riveted pipe*, having both longitudinal and girth seams held by one or more lines of rivets with projecting heads. From a capacity standpoint, pipe with countersunk rivet heads on the interior belongs in class 3.

Class 2, *girth-riveted pipe*, having no retarding rivet heads in the longitudinal seams, but having the same girth seams as full-riveted pipe.

Class 3, *continuous-interior pipe*, having the interior surface unmarred by plate offsets or by projecting rivet heads in either longitudinal or girth seams. Not necessarily described as "smooth."

The following are the suggested coefficients:

Class 1-a, $K'_s = 0.38$ for new sheet metal up to $\frac{3}{16}$ in. thick.

Class 1-b, $K'_s = 0.44$ for new plate metal from $\frac{3}{16}$ to $\frac{7}{16}$ in. thick, with either taper or cylinder joints.

Class 1-c, $K'_s = 0.48$ for new plate metal from $\frac{1}{2}$ in. up, with either taper or cylinder joints, and for plate from $\frac{1}{4}$ to $\frac{7}{16}$ in. thick when butt-jointed.

Class 1-d, $K'_s = 0.52$ for new butt-strap pipe of plate from $\frac{1}{2}$ in. up.

It will be noticed that no difference is made in class 1 between lap-riveted pipe of either cylinder or taper joint. Although there are appreciable differences in these joints, they seemingly reduce to approximate equality in carrying capacity. Lap-riveted pipe with taper joints "shingled" downstream have enlargements for the water prism at the lower end of each ring, but no contractions for the prism. Cylinder joints, on the other hand, have alternate enlargements and contractions of the water prism. The influence of the contracting offset is compensated for to a certain extent by the fact that the size of pipe and nominal velocity are based on the smaller rings and that there are somewhat lower velocities and lower friction losses in the larger rings.

No difference is made between single- and double- or triple-riveted pipe. As a rule the number of rows of rivets increases with the thickness of the plates, and inherent differences in capacity are included in the classification on the basis of plate thickness.

Class 2, $K'_s = 0.34$ for new girth-riveted pipe. This class covers all sheet and plate pipe with continuous-seamed longitudinal joints, but with the girth joints, particularly the field joints, made with the usual rivet heads inside the pipe. It includes lockbar and hammer-weld pipe with lap- or flange-riveted field (girth) joints; electric-weld, hammer-weld and drawn pipe with riveted bump joints; and all other types with surface continuous except as broken by a girth belt of rivet heads between field units. These girth seams are usually single-riveted when joints are bump or taper type, but of course require at least two rings of rivets for flange or butt-strap joints with exterior strap only.

Class 3, $K'_s = 0.32$ for new continuous-interior pipe. This class comprises all types of sheet and plate metal pipe that offer a practically uniform interior surface of relative smoothness. Full-welded crimped slip joint, lockbar with welded flange or leaded sleeve connections, bell-and-spigot, bolted-coupling pipes, all belong to this class.

Although a correction for water temperature is not justified by the degree of accuracy of hydraulic computations, the theoretical relationship is $K_s \propto \nu^{0.1}$, where ν is the kinematic viscosity.

Comparison With Other Formulas—The new formula is quite similar in form to the well-known Hazen-

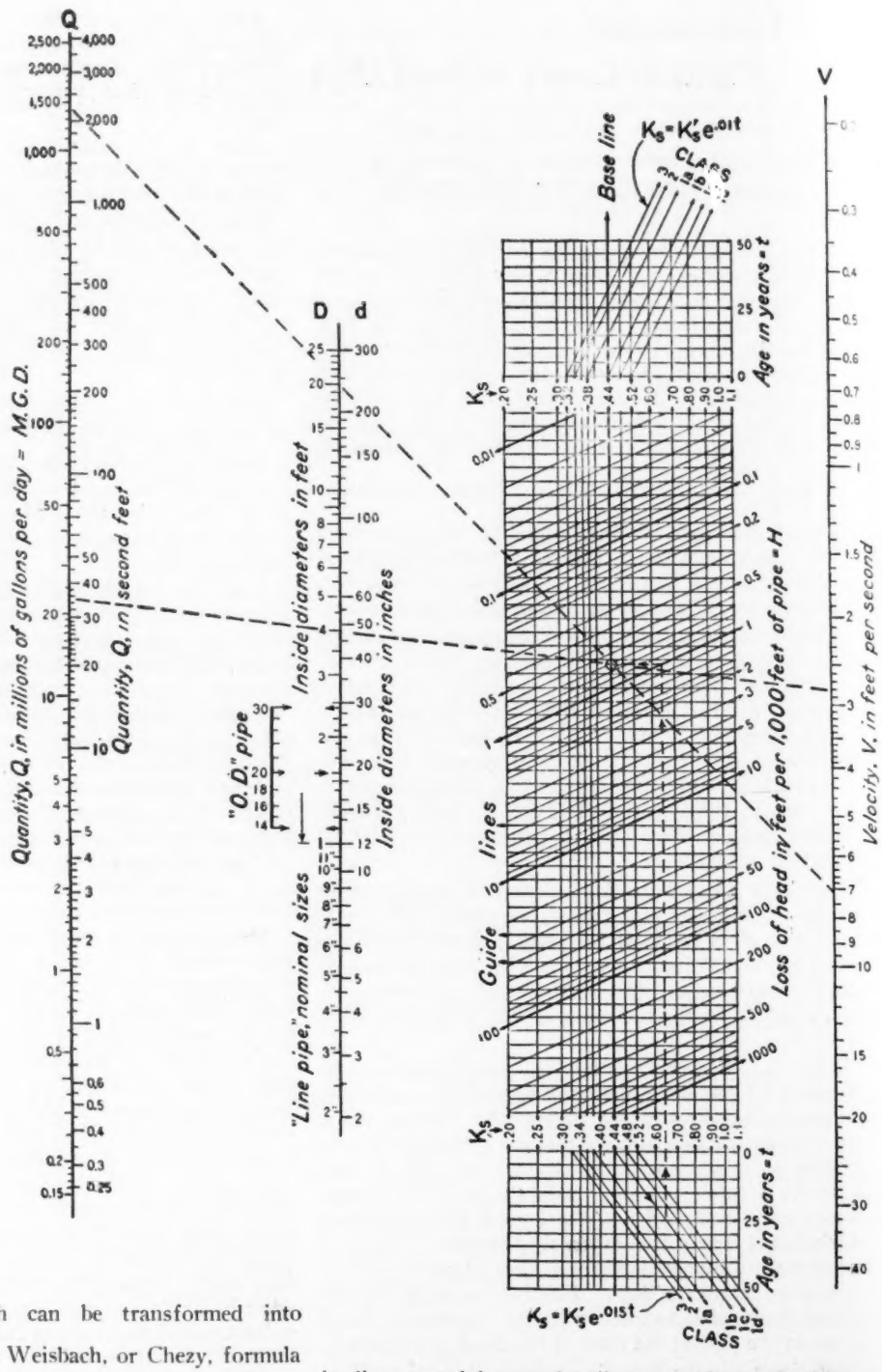


Diagram for computing friction losses in steel pipes

On this diagram an example has been indicated in which it is required to find the proper size of ordinary full-riveted pipe of class 1-b to carry 35 sec.-ft. at a friction loss of 1 ft. per thousand, when the pipe is 25 years old. An aggressive or corrosive water is assumed. When the pipe is new the value of K'_s would be 0.44. On the lower local diagram, a vertical drawn through the intersection of the diagonal line marked 1-b and the 25-year line indicates that the coefficient to use for this case is about 0.64. The vertical line is continued up uptil it intersects the line marked 1 ft. loss of head per thousand feet of pipe. From this intersection, a horizontal is drawn to intersect the base line. This new intersection can now be used as a pivot for a straight-edge and the rest of the problem solved by means of the other vertical scales. For the requirements stated, it is seen that a line drawn through the intersection point and the point representing 35-sec.-ft. will cut the scale of diameters at about 48 inches.

Williams formula, which can be transformed into $H = k \frac{V^{1.852}}{D^{1.167}}$, and to the Weisbach, or Chezy, formula $H = k \frac{V^2}{D}$.

It is felt, however, that the suggested formula contains exponents sufficiently removed from those of the Hazen-Williams formula to warrant a change, especially for high velocities and large-diameter pipes.

The value of Kutter's n varies at least 0.002—for instance, from 0.011 to 0.013—for identical surfaces when followed through a wide range of sizes and velocities, thus rendering the Kutter formula unreliable when considered with a constant value of n.

The use of the Kutter formula for closed conduits is discouraged by nearly all present-day authorities on the flow of water in pipes and channels. There are engineers, however, who prefer to use it, at least for comparison. The writer wishes to point out that the value of Kutter's n corresponding to a 6-in. continuous-interior steel pipe is approximately 0.009, but when found for a 6-ft. pipe $n = 0.012\pm$. Likewise, while $n = 0.015$ is about right for a new riveted pipe 8 ft. in diameter, a value of 0.013 would satisfy the conditions with the lower velocities in the same riveted pipe if its diameter were only 30 in.

To facilitate the use of the formula the diagram shown above has been constructed.

An Overturned 19,000-Ton Caisson Successfully Salvaged

Pier construction of Mid-Hudson Bridge delayed a year by remarkable accident in sinking largest open caissons ever used—Main span shortened to suit shift in pier locations

By GLENN B. WOODRUFF
Consulting Engineer, New York City

A 19,000-TON mass of reinforced concrete that was to become the base of one of the Mid-Hudson Bridge piers, at Poughkeepsie, N. Y., careened in the mud and clay of the river bottom, 60 ft. below water, when its sinking had just been begun. Fifteen months' persistent and skillful work was required to set it upright again. The remarkable operation is here recorded in compact engineering statement by an engineer closely connected with the work. Delay in publishing the article is due to an interesting lawsuit which developed from the mishap to the caisson and its restoration. The contractor sued to recover the cost of the salvage operation, claiming that the tipping was caused by instability inherent in the structure as designed, while the engineers claimed that it was caused by the contractor's excessive dredging below the cutting edge. The suit has been tried and a decision is pending.
—EDITOR.

THE CENTRAL NEW ENGLAND Railway bridge across the Hudson River at Poughkeepsie, N. Y., built in 1888, was the first structure in America to be founded by deep open-dredged caissons. They are still among the largest and deepest that have ever been placed. Forty years later, the Mid-Hudson Bridge, less than a mile away, was founded by the largest open caissons ever used. Its construction was marked by a most unusual accident and an equally unusual salvage operation—righting a partly overturned caisson that weighed 19,000 tons. The salvage work is the central element of the present account, which records the main facts of the entire pier-construction work.

The Mid-Hudson Bridge is a suspension bridge with a center span of 1,495 ft., east-side span of 755 ft. and west-side span of 750 ft. Both piers stand in deep water in the river, while the anchorages are on land. The original design contemplated a center span of 1,500 ft. and two side spans of 750 ft. each, but a 5-ft. change became necessary because the east pier as finally sunk after the accident mentioned was out of position.

At the pier sites the water is about 60 ft. deep. Borings showed that the subsoil at the east pier site comprised 45 ft. of very stiff clay, then 30 ft. of softer material (which proved to be predominatingly sand) and then a stratum of gravel and boulders. It was decided to found the pier on this gravel stratum, 135 ft. below water level. At the west pier mud was found for 35 ft., boulders at 100 ft. below water, and rock along the west side of the caisson area at 115 ft. A tidal range of 5 ft. had to be reckoned with in constructing the foundations.

The conditions at the east pier resembled closely those found during the construction of the railway bridge, 40 years before, but at the west pier conditions were somewhat different, for the railway bridge record makes no mention of a boulder layer.

For comparison with the Mid-Hudson operations it may be of interest to note that the railway bridge caissons were of timber construction 60x100 ft. in plan, and that each caisson had fourteen dredging wells 10x12 ft. in plan, while the remainder of the horizontal section was occupied by loading pockets. In a paper by John F.

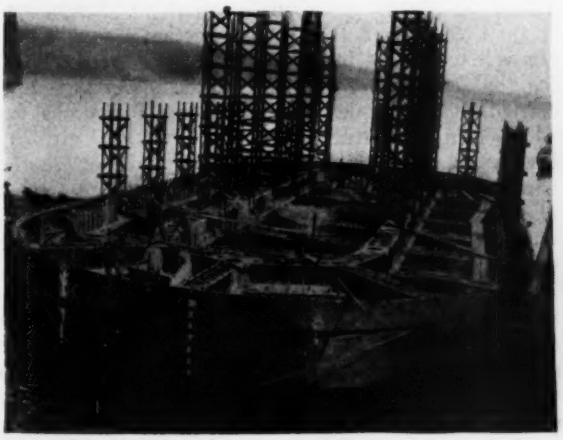


Fig. 1—Cutting edge section before sinking
This portion was built up as a core and formed the support for the upper concrete section.

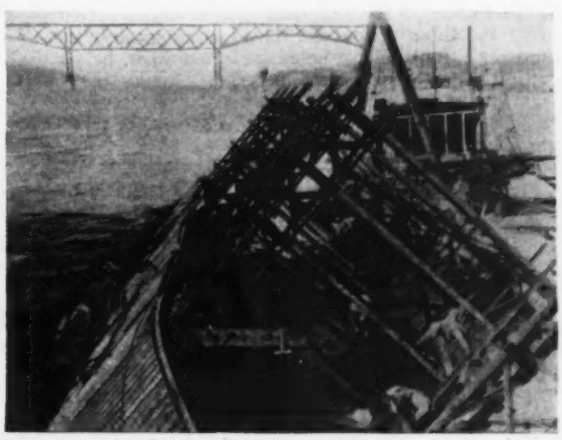


Fig. 2—East caisson after tipping
The entire movement through a 42-deg. arc occurred in about 1 min. One edge dropped 29 ft. The other rose 11 ft.

O'Rourke, "Construction of the Poughkeepsie Bridge," in *Transactions*, Am.Soc.C E., June, 1888, their action during sinking is described as follows:

> When dredging begins there is no side friction. The material is soft, and the crib follows the dredging easily and evenly. When the crib has penetrated perhaps 20 ft. into the bottom, the material is more compact and side friction has become considerable. It no longer moves steadily, but by intermittent though gradual descents. Toward the end the crib hangs until the bottom is undermined, when it drops sometimes as much as 10 ft. at once, its motion being like that of a weight set free on the surface of a thick, soft cushion; and it comes to rest without jar. The dredge can only dig well holes, the areas of which are about one-fourth that of the bottom of the crib, and it must depend upon the material falling in from the sides for the greatest part of the excavation. These holes are often 30 ft. below the cutting edge when in hard material.

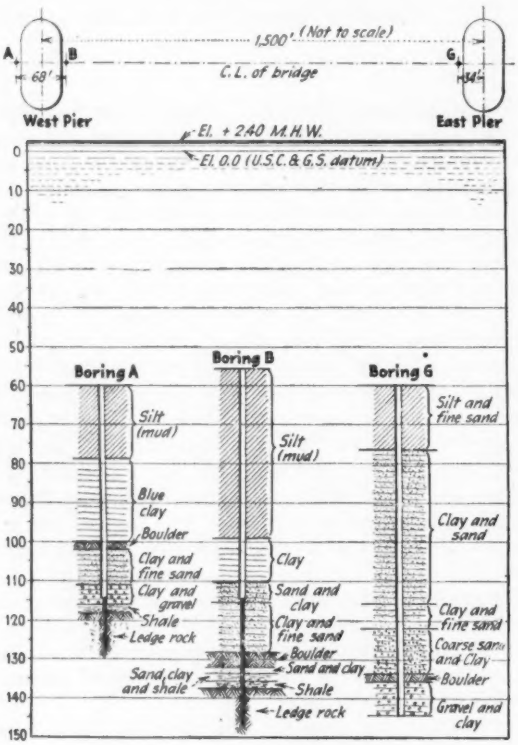


Fig. 3—Typical boring results

Deep soft ground led to use of open caissons for pier foundations of Mid-Hudson Bridge.

Large Concrete Caissons

As the depths necessary to secure a satisfactory foundation were beyond the limits of the pneumatic method, the open dredging method was selected for the Mid-Hudson pier bases. The usual type of timber caisson would have required loading pockets of large dimensions to provide the weight necessary to insure penetration, leaving correspondingly small dredging pockets; removal of the material from under the loading pockets and the wide exterior walls would therefore have been difficult. It was desired to obtain the necessary weight by constructing a cellular caisson of structural steel and reinforced concrete. For flotation prior to landing on the river bottom a removable bottom at the cutting-edge level became necessary.

Each caisson as designed and built consists of a concrete-filled steel cutting edge and truss system, 60x136 ft. and 20 ft. deep, with semicircular ends, composed of an outer shell of ½-in. steel plate and heavy bracing trusses, all filled and incased with concrete to form outer walls 3½ ft. thick and partition walls 2½ and 3 ft. thick. This lower section was proportioned to resist all stresses during launching and during the early part of the sinking. Above this the structure was of reinforced concrete jacketed with an exterior shell of 4-in. timber. The horizontal section of the concrete walls was made so that, at all times prior to landing, the concrete walls would be only a small distance above water level. A system of trussed steel columns at all wall intersections extended up through this section and carried 4x3-in. horizontal angles at 4-ft. spacing as supports for the outer planking and for the inner wall forms. This frame served to maintain the lines of the construction. The base area of each caisson is about 7,400 sq.ft.

The false bottoms designed by the contractor consisted of 14 in. floor timbers spanning from the cutting edges to a 24x28-in. strongback, which was supported by diagonal timber braces abutting against the walls. Horizontal braces at the top completed a truss system. The 14-in. timbers were deeper than necessary but were ordered for the east caisson before the details of the bracing system had been developed; 12-in. floor timbers were used for the west caisson. All joints in the floor were calked with white pine wedges.

The caisson was about 25 ft. wider than the masonry pier. In order that the underwater projection might not be a menace to navigation, the design provided that the top of the caisson in the final position should be 31 ft. below water. This necessitated a removable cofferdam on top of each caisson, which was placed before the cutting edge reached its final position, and which therefore had to be so braced as not to interfere with the dredge bucket operation. An interesting feature of this cofferdam was the use of the concrete walls to replace timber crossbracing that would otherwise have been necessary (Fig. 4). This obviated the necessity (for the lower portion of the dam) of cutting out braces and rebracing against the completed concrete walls.

Building and Floating the Caissons

The lower steel sections, with the false bottoms in place, were fabricated on ways at the yards of the Staten Island Shipbuilding Co. and towed to Poughkeepsie. Upon their arrival this bottom section was filled with concrete to about 4-ft. freeboard; then the work of building the successive 16-ft. lifts of the upper section was started. The sequence of build-up operations was: (1) Placing the structural-steel columns and girts. (2) Placing the 4-in. exterior planking, built on shore in panels 15x16 ft. and calked with oakum and pitch after placing. (3) Placing reinforcing steel. (4) Placing interior forms, made up in panels 8 ft. high. (5) Filling with concrete.

The mixing plant was built on a scow 40x120 ft. Sand and stone stored in bins 30 ft. above the deck flowed down into a measuring hopper and thence to the mixers. A movable horizontal belt transported cement from covered delivery barges to the cement house on the mixing scow, and a second belt carried it thence to the mixing platform. Two 1-yd. electric mixers dumped into a 1-yd. bucket.

At first the concrete was distributed to the walls of

the caisson by a horizontal belt. This arrangement, adopted to meet a specification prohibition against chuting, proved unsatisfactory, principally because concrete was spilled by rocking of the mixing scow. The spilled concrete fell to the false bottoms and was a factor in the trouble later encountered in removing the bottoms. The engineers then permitted chuting, and the belt conveyor was replaced by chuting equipment, which proved satisfactory.

For each foot of height of caisson walls, 200 cu.yd. of concrete was required, or for the 16-ft. lift a total of 3,200 yd. With a force of 150 men the contractor was able to average 9 in. sinking per day.

Calculations by the engineers during the sinking indicated stability at all stages, but as a safeguard against unfavorable contingencies the engineers ordered, when caissons approached 60-ft. draft, about 500 tons of ballast to be placed in the pockets. The sand used by the contractor for this purpose proved a source of trouble later when the bottoms were to be removed.

In the construction of the caissons, provision was made for anchor attachments, two at the ends, two at the sides and one at each quarter point, or at eight points in all, around the perimeter of the caisson 19 ft. above the cutting edge. Similar provision was made at points 53 and 80 ft. above the cutting edge, but the upper attachments were not used. Eight concrete blocks, each of 15 cu.yd., were placed on the bottom of the river about 350 ft. from the caisson. A 1¾-in. plow steel cable from each block had, about 50 ft. from the caisson, a four-sheave purchase which led to the lower anchor attachments on the caisson, the lead line being tied to the top of the caisson. A second 1¼-in. line was later led from the 53-ft. fastenings and connected to the 1¾-in. line about 150 ft. from the caisson. These anchors were ample for their intended function of securing the caissons in correct horizontal position before they were landed on the river bottom.

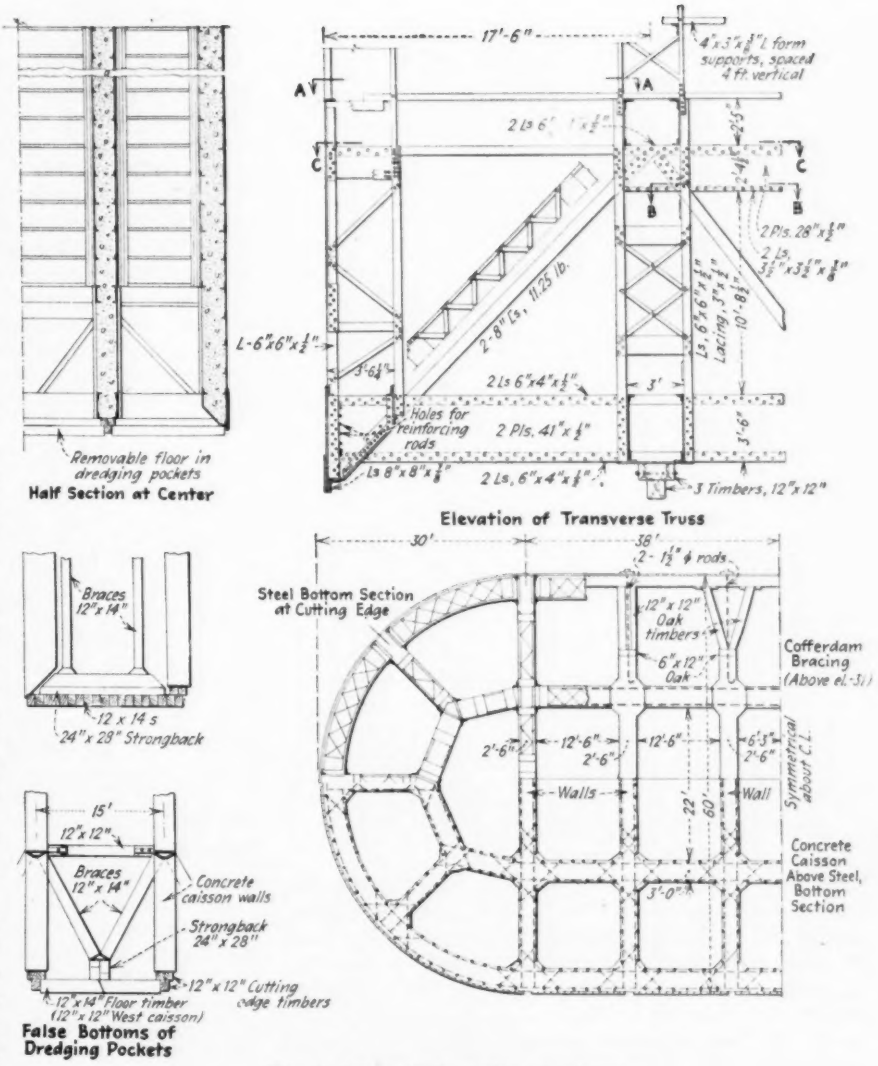


Fig. 4—Lower 20-ft. section of caissons

This section consisted of a concrete-filled steel shell braced by a heavy structural-steel frame; remainder of height is reinforced concrete. Collapsible false bottoms used in floating and sinking the caissons gave much trouble in removing.

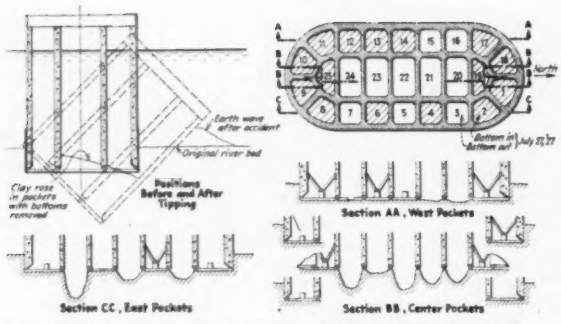
Sinking the West Caisson

The caisson for the west pier reached Poughkeepsie April 23, 1927. The work of building up the concrete walls proceeded without incident, and on July 1 the caisson was landed on bottom, at 57 ft. depth. By July 12 the outside walls had been raised to 69 ft. above the cutting edge, which then was at 60 ft. depth.

The braces in pocket 12 were dynamited and the bottoms came up suddenly, resulting in a decided settlement at the southwest corner. To level the caisson, the bottoms of pockets 3, 7 and 16 were shot in quick succession. This resulted in a level caisson, but during the operation, with a vertical settlement of 6 ft., the caisson moved 8.2 ft. west of correct location. The cause of this motion has never been completely understood. The most plausible explanation is that, when pocket 12 was opened, most of the material entering the pocket came from the west side of the caisson, leaving a void into which the caisson moved when the other pockets were opened.

To move the caisson eastward a surcharge of 1,500 tons of gravel was piled along the west side of the caisson. The effect was to produce a pressure toward the east, so that, in the subsequent vertical motion a movement to the east was obtained. The caisson in its final position is only 1½ ft. west of correct location.

At the west caisson the concrete walls were built up, and later the cofferdams placed. Practically all the sinkage was gained by removing the false bottoms, the


Earth wave after accident
Original river bed
Clay rose in pockets with bottoms removed
Positions Before and After Tipping
Section AA, West Pockets
Section CC, East Pockets
Section BB, Center Pockets

Date	Av. El. C.E.	East Side Dredging Wells 1	2	3	4	5	6	7	8	9	West Side Dredging Wells 10	11	12	13	14	15	16	17	18	Center Dredging Wells 19	20	21	22	23	24	25
June 30	-61.6			K				K																		
July 1	-61.8																									
2	-62.5								K																	
3																										
4																										
5	-62.6																									
6	-62.8																									
7	-63.1	K						B																		
8	-63.3					K																				
9	-63.4																					K				
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11	-63.9				B				K			K					K									
12	-64.2		B																							
13	-64.6													K								B				
14	-64.8																				B					
15	-65.0																B								B	
16	-65.2																									
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18	-65.5			30 bl.		40 bl.		50 bl.													28 bl.		28 bl.			
19	-65.5						K									K										
20	-65.5	K									K											K		K		
21	-66.0																6 bl.					B				
22	-66.2																								15 bl.	
23	-66.2																									
24				31 bl. 6		28 bl.																		B		
25	-66.3			-5		-4		-2									-1				-2	48 bl. -4	0.0		-5	
26	-66.6			-5		-5		-2								B	-1				-1	-6	34 bl. 27 bl.		-5	
27				-5		-5		18 bl. -11									-1				-1	-8	34 bl. 31 bl. -21		31 bl. -21	

K - Braces removed B - Bottom out Figures denote other excavation in cubic yards or depth below cutting edge

Fig. 5—Condition of bottoms and of pocket excavation before tilting of east caisson and resulting position of structure

underlying material rising in the open wells. The last bottom was removed on Oct. 7, 1927, with the cutting edge at 102 ft. depth. The average rate of sinking from the time of landing, which was governed by the time required to build up the walls and erect the cofferdam, was about 6 in. per day.

The west cutting edge having reached the boulder formation on Oct. 7, all pockets were dredged to cutting-edge level and the slow work of removing the boulders started. This was accomplished mainly by excavating in the west pockets below the cutting edge, jetting away the clay surrounding the boulders so that they would fall into the excavation, and removing them by the bucket. It required over a month to sink the caisson 8 ft. to depth 110.

Borings had indicated that a satisfactory foundation would be secured at 115 ft., but additional exploration under the contract indicated soft material below this elevation under the east edge. It was therefore decided to carry the concrete foundation to rock over its entire area. To insure the stability of the caisson during the cleaning and refilling operations, pockets 5, 6 and 4 were successively excavated to rock at depth 126 ft. and refilled with concrete to depth 115 ft. This operation was started on Nov. 12, when the cutting edge was 110 ft. down. The work took a week, during which time there was practically no movement of the caisson. Excavation then proceeded, and by Nov. 30 the cutting edge was at 114.1 ft. depth, at which elevation ledge rock was encountered at the northwest corner of the caisson and the east edge was nearly in bearing on the concrete already placed. The center of the caisson was then cleaned out to rock and the center pockets concreted to 34 ft. below water, using a 2-yd. bottom-dump bucket. The north end of the caisson was next cleaned and concreted, and finally the south end.

There was no movement of the caisson after the concreting operations began. Measurements of the concrete placed indicate that the volume of material below the cutting edge was completely replaced by concrete.

The filling to El. —34 was completed on Dec. 23, 1927, at which time it became necessary to suspend operations for the winter. When work was resumed, March 8, 1928, the cofferdam showed little damage and could be unwatered after minor repairs. But a deposit of laitance over 20 ft. thick had to be removed from the top of the concrete, its lower layers requiring air hammers. The demarcation between the laitance and the concrete was distinct, and the concrete appeared to be of excellent quality. The west pier was completed June 12, 1928.

Work on East Caisson

The caisson for the east pier reached Poughkeepsie on March 26, 1927. Building up the walls proceeded as described, and on June 6 the structure was landed on the bottom, at 56 ft. depth. Soundings had disclosed that the riverbed was about 2 ft. higher under the east than under the west side of the caisson. It was anticipated that the material would be displaced when the caisson was landed, but this did not occur, and at all times before the accident the caison had a slight list to the west.

By June 30 the concrete walls had been built up to 72 ft. above the cutting edge, which was then 61.6 ft. down. On this date the braces were removed from pockets 1, 3 and 7 by exploding 3 lb. of dynamite at the foot of the diagonal braces. Contrary to expectation, the bottoms failed to give way when the braces were removed, and their removal proved difficult. They were slowly removed by first ramming them with a heavy concrete pile until the timbers were broken up and then chewing them out with a dredge bucket. The progress of the false-bottom removal is recorded in Fig. 5, which also shows, by dates, the material excavated from the various pockets. Prior to July 26 very little excavation had been done, except that incidental to removing the bottoms and cleaning out the material that had come up in the pockets above the cutting edge. All pockets were filled with water to river level.

Caisson Tips Over

On the night shift of July 25-26 the contractor removed 164 cu.yd. of material from the center pockets. On the following night shift, July 26-27, he excavated 254 cu.yd. of material from the center and east side pockets. At 4:30 a.m. on July 27 the caisson listed to an angle of 42½ deg. from the vertical (Fig. 5); from the estimate of a foreman on the caisson at the time the entire movement occurred in about a minute. The east edge dropped about 29 ft., the west edge rose 11 ft., and the center of gravity dropped 9 ft. After motion started it continued until resistance under the east edge and the building up of a bank or earth wave at the east side overcame the momentum.

It is the opinion of the engineers, the author included, that the sole cause of the accident was that the weakened walls of clay, which on the east side served as supports, were unable to withstand the comparatively high pressure of 2 tons per sq.ft. and failed. The lateral support of the material under the center and east walls had been removed, and this material had been also subjected to the softening effect of water from the sides. The

excavation had created, in effect, a ditch into which the caisson overturned.

Steps were at once taken to prevent further overturning. Two lighters were placed along the east edge of the caisson with attachments to the steel frame. Two 150-ton crib anchors were sunk 600 ft. west of the caisson and connected by lines to the west top. Pontoons with a total capacity of 300 tons were attached to the east side of the caisson but were not in working condition until Aug. 13. About 400 cu.yd. of gravel was banked on the river bottom along the east side of the caisson.

This work took about a month. During this time the caisson settled vertically about 1 ft., at a decreasing rate, and the angle of list increased about 1 deg., but after Aug. 20 no further movement took place until the righting motion started.

Righting Operations

With the caisson secured against further overturning, attention was turned toward the problem of righting and restoring it, as nearly as possible, to its proper location.

The total weight of the caisson was 19,000 tons and its submerged weight 12,000 tons. A vertical line through its center of gravity passed slightly to the east of the east cutting edge, and there were two additional resistances which would oppose righting: the resistance of the material under the bottom and the adhesion between the east side of the caisson and the clay bank.

It was evident that the attack should be along two lines, supplying righting moments and excavating under the bottom. The greater the moment applied and the less the excavation, the nearer the caisson would be restored to its proper lateral position. Had it been practicable to apply moments of sufficient magnitude, the center of rotation might have been very near the same point as the center during the accident, and the caisson would have come to the vertical in true position. If, on the other hand, excavation had been the sole means employed, there would have been no tendency for the caisson to return to the vertical. The probable path of motion would have been for the caisson to slide along its east side, with the possibility that the cutting edge might move to the west even faster than the slope of the east bank would indicate. The engineers therefore insisted that no dredging be done before righting moments of a considerable magnitude had been applied.

It was very desirable that the righting motion be secured with as little settlement as possible. Any considerable additional vertical load applied to produce rotation would have probably caused additional vertical settlement; hence efforts were made to secure moments without adding vertical load. This could be done by using horizontal forces or, preferably, uplifts at the east side of the caisson.

Restoring Moments Applied

The various pulls applied to the caisson to produce this torque are shown diagrammatically in the sketch, Fig. 6. Their amounts and moments about the east cutting edge were as follows:

	Date Active	Force Tons Net	Moment Foot Tons
Loading in pockets 11, 12, 13, 14 and 17	Oct. 25, 1927	710	18,000
Cribs, west side	Sept. 10	210	9,000
Seven lines to west	Sept. 10		
Twelve lines over carfloat	Nov. 26	1,000	99,000
Boom loads	May 20, 1928	250	
	Increased June 1 to 5	282	26,000*
Float east side	June 14	200	8,000

The lines to the west produced the greatest force toward righting the caisson. As first placed each line consisted of a $1\frac{3}{4}$-in. plow steel rope attached to rockfilled cribs placed about 600 ft. west of the caisson and attached to the caisson by a six-part tackle. To secure a greater leverage, a carfloat was placed at the west of the caisson and the lines carried over the float. As these lines were first rigged in the fall of 1927, they had to be tightened at low tide, and the full pull occurred only at high tide. Later, to give a steady pull regardless of the tide, the free end of the main tackle was connected to a six-part luff tackle, the free end of which passed over a pulley and carried a $2\frac{1}{2}$-ton weight.

The lines over the carfloat were so rigged as to keep the forces in play at all stages of the tide and were of prime value and effectiveness, without adding weight to the caisson.

Since all attachments had to be made by divers, the work was necessarily slow. The multiplicity of lines made it difficult to place additional rigging.

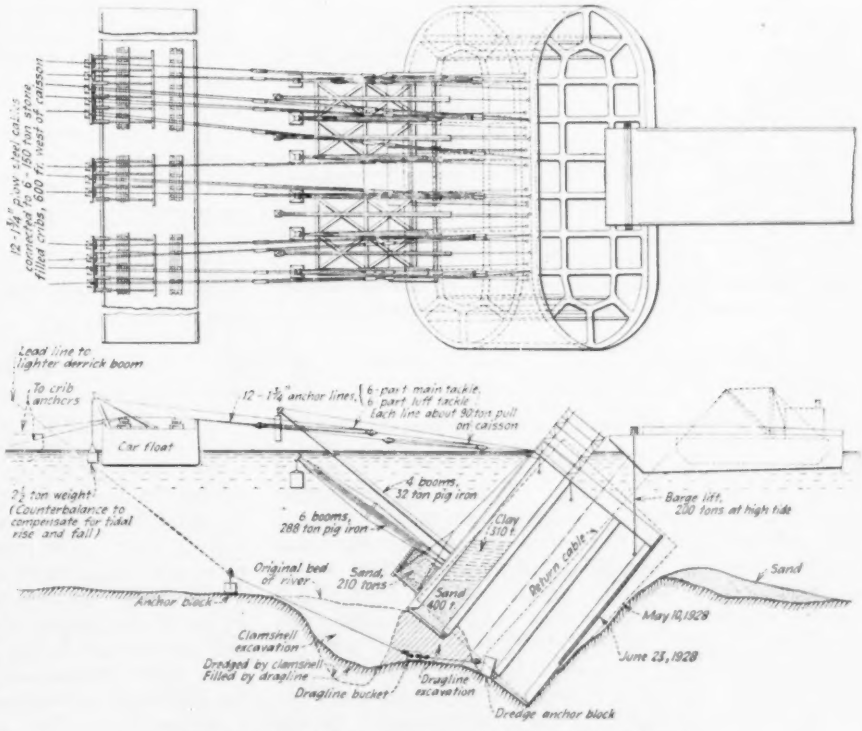

12 - 1¾" plow steel cables connected to 6 - 150 ton stone filled cribs, 600 ft. west of caisson
Lead line to lighter derrick boom
To crib anchors
12 - 1¾" anchor lines, 6-part main tackle, 6-part luff tackle
Each line about 90 ton pull on caisson
Car float
2½ ton weight (Counterbalance to compensate for tidal rise and fall)
4 booms, 32 ton pig iron
6 booms, 288 ton pig iron
Barge lift, 230 tons at high tide
Clay (310 t.
Original bed of river
Sand, 210 tons
Sand 400 t.
Return cable
Sand
Anchor block
May 10, 1928
Clamshell excavation
Dredged by clamshell
Filled by dragline
Dragline bucket
Dragline excavation
June 23, 1928
Dredge anchor block

Fig. 6—To right the caisson, weighted booms and pulling tackles anchored to sunken cribs were rigged to apply 1,500 tons pull to the west at the top edge, while the soil was being dug away under the west half of the base

These methods of applying righting forces are only a few of those considered. Roofing over the east-side pockets and putting on air was seriously considered, and work on the plan was started. It was abandoned because the amount of water that could be safely displaced was limited by the strength of the vertical reinforcing steel, and there was doubt of making an effective air seal at the top of the pocket by placing concrete through a tremie. Another plan started was to build a cofferdam over the area of the caisson. This plan was abandoned, since it was not considered safe to depend on the water-

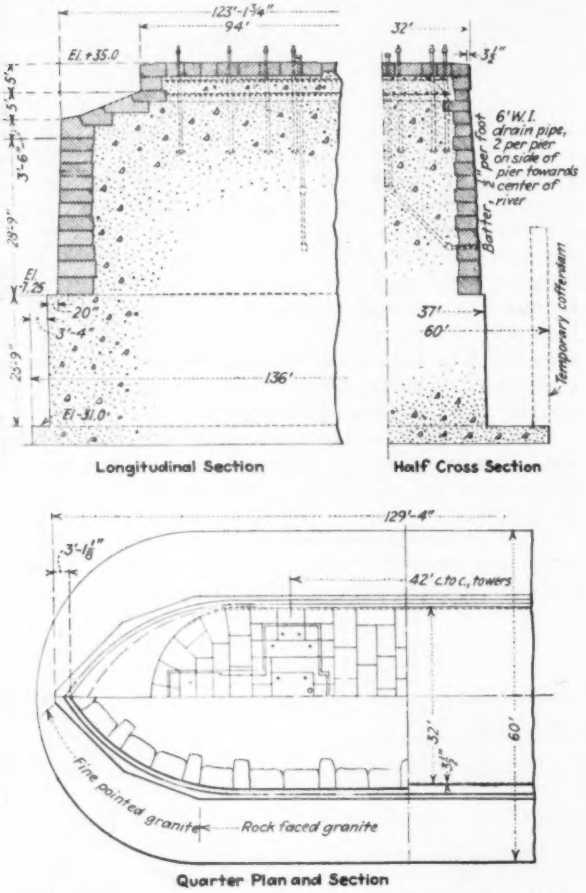


Fig. 7—Stone-faced concrete piers built on the caisson substructures within removable cofferdam inclosure

tightness of the seal of clay in those pockets in which the bottoms had been removed.

Excavating Under Bottom

The excavation of material from under the caisson presented unusual difficulties. Due to the inclination of the caisson, excavation by buckets through the pockets was extremely slow and, after the cutting edge was reached, became impossible, since the bucket swung under the edge. Several types of hydraulic ejectors and jets were tried without success. A self-propelling jet, developed by the United States Navy, proved very effective where small volumes were to be removed.

In the fall of 1927 a trench was excavated along the west side and around the ends of the caisson. In the spring of 1928 this trench was deepened to 85 ft. below water. A diver jetted a hole from pocket 22 to the west side and passed a line through this hole, to which was attached a crescent-shaped bucket. This device proved very successful, the material being dragged from under the caisson into the previously excavated trench.

On May 11, 1928, a slight righting motion of the caisson was noted. After this date a very steady motion of the caisson, averaging 30 min. of arc daily, was secured, until in early August the caisson was nearly vertical. This righting motion had been secured with no lowering of the east cutting edge and with the caisson about 12 ft. out of position instead of the 16 ft. that would have resulted had the rotation been about the east cutting edge.

At this time the righting appliances were removed. Some excavation was done at the east side and some gravel placed at the west side of the caisson in an effort to move the caisson eastward. The remaining false bottoms were removed and the cofferdams built on top of the structure.

On Nov. 20, 1928, the final sinking of the caisson was started, the cutting edge being at 112 ft. below water. In eighteen days the contractor sank the caisson to its final position, with cutting edge 134.4 ft. down and resting in a stratum of coarse gravel. By Dec. 26, 13,000 cu.yd. of concrete had been deposited in the upstream half of the caisson. The laitance was cleaned off this concrete and from the downstream pockets, and operations were closed for the winter. Work was resumed on March 19, 1929, and the pier completed on May 16. A total of 14,200 cu.yd. of concrete and 1,600 cu.yd. of stone were placed in less than two months.

Review of Design and Construction

At the end of such a project, especially when there has been a serious mishap, the question arises as to whether the design was faulty or could have been advantageously changed, and the construction procedure altered so that any hazards might be reduced. The author's conclusions are as follows:

In its general conception the design of the caissons was well adapted to their purpose and to the conditions encountered at the site.

The thin concrete walls of the caisson permitted the dredge buckets to get very close to the cutting edges. Had these walls been thicker or had loading pockets with permanent bottoms been used, it would have been most difficult to remove the material from under the cutting edges and loading pockets. Probably it would have been impossible to have sunk the west caisson to the desired elevation.

The weight of the walls was the maximum that would permit floating the caissons on false bottoms. This weight was more than sufficient to overcome all skin friction and other resistances to sinking. Hence there was no need of loading pockets.

The ratio of the width of the caisson to its height during the dredging operation (60 ft. wide to 60 ft. high at the start, and 60 to 135 ft. at the finish) was unusually large. The caissons were very easily controlled as to level at all stages of the sinking.

The use of the steel columns and girts proved valuable in permitting speedy erection of the exterior planking and the interior forms.

In regard to temporary parts and conduct of the work, the following may be noted:

Where the riverbed consists of a fairly stiff material, as was the case at the east caisson, the false bottoms should be constructed with more braces. In this way the shorter spans would permit lighter material for the floor.

All operations should be so conducted as to maintain symmetry as nearly as practicable. If the first pocket removed at the west caisson had been No. 22, the trouble with this caisson would probably have been avoided. Likewise, dredging should be done with the same regard to symmetry. As little dredging as possible should be done until the caisson is well embedded in firm material. All dredging should be done so as to keep the caisson rim-bearing, the sinkage being gained by the gradual failure of the cutting-edge support.

The Mid-Hudson Bridge was constructed by the department of public works, of the State of New York. Frederick Stuart Greene, superintendent of the department, and J. S. Bixby, division engineer, were in constant touch with the work. L. S. Hulburd, as senior resident engineer, was the state's representative on the ground. The contractor for the main piers was the Blakeslee Rollins Corp., of Boston, with W. G. Cheever as superintendent. The design and construction of the bridge was under the direction of Ralph Modjeski and Daniel E. Moran, of New York City, as consulting engineers. P. P. Angier served as resident engineer until Jan. 1, 1928, when he was succeeded by C. W. Hanson. The author was in direct charge of the design of the work and had general supervision of the fieldwork under the direction of the consulting engineers.

Estimating Fees—A Symposium

A presentation of both sides of the question of charging fees for bidding—Engineers view plan with suspicion—Contractors claim it lessens useless economic loss of excessive bidding.

IS THE practice of competitive bidders charging a fee for their proposals sound and justifiable? Engineers say it is not, contractors are divided in opinion and officials of organized contracting declare it is, according to many letters received by *Engineering News-Record* since the publication of an editorial on the subject in these pages Nov. 27, 1930. Some of the letters were replies to a request for an opinion, others were unsolicited. Consulting engineers, chief engineers of railoads and large industrial firms, officers of the U. S. Engineer Corps, and city, county and state officials represented the contract-awarding viewpoint. General and building contractors and secretaries of organized constructors' groups contributed opinions from the contracting industry. The *Constructor*, organ of the Associated General Contractors of America, also expressed its viewpoint on the subject.

Of all the engineers reporting, only one favored the plan, and he only partly. Quite a few viewed it with suspicion, pointing out possibilities of price-fixing or bidding solely for the purpose of collecting the fee. Two declared intentions of resorting to some means other than competitive contracting for carrying out construction projects if the system goes into effect in their territory. Organized contracting groups declare that the fee practice restricts the number of bidders and lessens a useless economic loss caused by excessive bidding lists. Some contractors claim the system puts the cost of bidding where it belongs. Other contractors were bitterly against the plan. They claim to know of fees collected on "complimentary" bids, and of false information being passed out to bidders regarding the approval of architects and engineers to the fee system on specific projects. They also allege that contractors unwilling to enter into bidding-fee agreements are intimidated through subcontractors and material supply interests.

Opinions of Engineers

Opposition to the practice of charging fees for bidding was expressed by Myers, Noyes & Forrest, consulting engineers, of Dallas, Tex. They further state:

We recall very vividly the scandals which arose during the bidding on bridge work a few years back and feel that a renewal of the practice of making a charge for preparing bids will again bring up these old charges of contract pooling, probably with a great deal of justice. We have had no experience with bidding fees but at times we have felt that the system was being used to the disadvantage of the owner and without direct knowledge on the part of the owner or the engineer. We have felt that this has occurred on our work at times and naturally are very much opposed to it. We cannot see where the estimating fee plan is an equitable solution of the contractor's bidding problem.

Black & Veatch, consulting engineers, Kansas City, Mo., declared that they cannot discuss the question of estimating fees from the standpoint of any actual experience with such a plan since, as far as they know, it has never been practiced in the Kansas City territory. They expressed further opinion as follows:

Our reaction to the scheme is decidedly adverse. There seems no more justice for such a procedure in submitting bids for construction work than in submitting proposals or bids in every other line of endeavor. Frankly, we think the engineering and architectural professions should do everything in their power to suppress such a practice. More real good can be done the contractors if the architects and engineers do everything within their power to see that the work on which bids are received has been clearly and fully explained in the plans and specifications and then assure the contractor of unprejudiced consideration and absolute open competition in the bidding.

Defeats System

J. E. Sirrine & Co., engineers, Greenville, S. C., told of actual experience with the plan and reported unethical practice in this connection:

We have run into this situation in a few cases, and we invariably notified the contractors that such procedure would not be permitted. We know for a fact that an effort has been made among certain groups of contractors to try to "freeze out" or ostracize contractors who would not join in the practice. We are against the practice of charging an estimating fee, and feel that the cost of estimating is a part of the contractors' overhead, and it is our opinion that it will lead to the practice of contractors entering into competition merely to collect an estimating fee without any intention of submitting a bona fide bid. We further believe that the practice will lead to collusion and the fixing of bids and bidding, adding unnecessarily to the cost of the contracting work. We have never permitted the payment of a bidding fee, as we have always found it possible to break up the program by permitting independent contractors to bid, thereby giving them the advantage, compelling the other contractors to eliminate the bidding fee. We were advised that efforts were made to include a bidding fee on some of our work, but the interested contractors were unable to charge the fee

due to the presence on the list of independent contractors. Our attitude toward the subject has been that if the contractors openly and avowedly state that they would charge a bidding fee, we would have no right to object to such an action, for we would merely notify the owners of the practice and permit them to make such a selection of contractors as they thought might be to their interest. We think the practice wholly unsound and will eventually fail for this reason.

Hawley, Freese & Nichols, consulting engineers, Fort Worth, Tex., are against the application of the bidding fee in connection with public work or work for which no invitation to specific bidders was issued, and can see no reason why a pool or association should be made for the purpose of collecting a fee. However, they believe that on private work, "where certain bidders are requested to bid and the bidding is limited to those specific bidders, it is entirely proper for the owner to pay a bidding fee directly to the contractor, whether the contractor is successful or not. This thought is based on the theory that on a closed bidding of that kind the owner has fully determined the responsibility of each of the contractors invited to bid, that he is certain of their integrity and that he desires them to spend considerable time and some money in the preparation of the bid."

Competitive Contracting in Danger

C. W. Johns, chief engineer, Chesapeake & Ohio Railway Co., Richmond, Va., stated that as far as he knows the estimating fee system is not applied to any work done by his road and that as a result he has had no actual experience with the plan. But he expressed the opinion that "We most strenuously oppose this practice, which we consider amounts to collusion and which, in the end, would destroy competition, essential to the handling of construction work by contract. We would be in favor of adopting whatever methods are necessary to suppress this practice among contractors, which, if it becomes general and recognized, would no doubt eventually make it necessary to adopt other means of doing work than by the present contract system."

The attitude of a large industrial firm was expressed by H. L. Noyes, chief engineer, Union Carbide Co. Mr. Noyes said that he is not in favor of the practice of contractors charging estimating fees for bidding, as under this practice there is great danger of collusion among the bidders, with the result that the owner will not get free competition and that building costs might be raised to a prohibitive figure. He said further: "The American Institute of Architects and the engineering societies might well condemn this practice, and if the Associated General Contractors has the interest of its organization at heart, it should take a stand to discourage the practice, as in my opinion it is bound to react against the contracting business as a whole."

Two officers of the U. S. Engineer Corps stated they are opposed to the estimating fee practice. One of them added: "If contractors can enter into collusion to recoup a bidding fee, why can this not be carried further and prices boosted along other lines? Collusion of one kind will lead to collusion of another and is opposed to the system of free competitive bidding. Reliable contractors should be opposed to a system that will class them among racketeers."

In the highway field Charles H. Moorefield, state highway engineer, Columbia, S. C., stated that he is opposed to the practice of contractors charging fees for estimating to bid because such practice would tend to restrict legitimate competition by establishing at least a limited concert among the group of bidders concerned. The opportunity to bid should, in the opinion of Mr. Moorefield, be open on the same basis to all who are reasonably qualified and the act of bidding should be wholly voluntary, otherwise there is no way of measuring the competitive interest that bidders feel in the work. He states that he has had no experience with bidding fees on highway work.

William N. Carey, chief engineer, department of public works, St. Paul, Minn., said: "I am decidedly against the practice of contractors charging fees for estimating or bidding. This practice does not exist in the Northwest and would be very coldly frowned upon if anyone tried to start it here."

Illegal in Ohio and Indiana

In Ohio it is illegal to pay the unsuccessful contractors for the preparation of their bid, according to George B. Sowers, commissioner, division of engineering and construction of the city of Cleveland. "The cost of preparing a bid for any kind of public work is a small sum which the contractors gamble with in figuring the public work. Unfortunately on most public work it is impossible to exclude bidders. It would therefore be very unwise to pay for the preparation of bids from companies who are not capable of performing the work."

A. H. Moore, city civil engineer, Indianapolis, stated that he is against the practice of charging estimating fees and has had no experience with them, "for the simple reason that the Indiana laws prevent such a practice, and as a large amount of our work is paid for by bond issue, I do not believe that any reputable bond attorney would approve the issuance of bonds with any item of this sort included. Personally, I would not tolerate any such method if it were in my power to prevent."

A sympathetic note for the contractor was received from V. R. Covell, chief engineer of bridges, Allegheny County, Pa., who is not in favor of the fee system, but said "Anyone at all conversant with present-day practice must recognize that much time and expense are involved in preparing bids, and it may not be unreasonable for thoughtful contractors to try to adopt some plan by which they may be remunerated for such expense. It should be remembered that much of the expense of estimating falls upon the sub-bidders who submit prices on a goodly part of the total cost. If fees for bidders were to be adopted, then in all fairness those who submit the sub-bids should be included in the fee—a practice which would become very much involved. It seems to me very evident that a system of fees for bidders would likely invite 'complimentary' bids from bidders who have expended little or no effort in preparing the bid and whose chief interest was to collect the fee." Mr. Covell offers a suggestion to contractors in the following: "I believe that the efforts of progressive contractors should be exercised toward establishing the practice of employing quantity engineers who will study the plans, calculate the quantities involved in every item of construction and then furnish these estimated quantities to all prospective bidders."

A further development of the quantity survey idea came from Oscar Euphrat, president, American Institute of Quantity Surveyors, who said:

There can be no question that the cost of preparing estimates is a part of the contractor's cost of doing business and as such, is overhead expense. You say that everyone in any other business also has the same or a similar expense in preparing a quotation. We would suggest, however, a decided difference between the contractor's business and any other. All other business men, when quoting a price, base the same on the buyer's inquiry, which either specifies exactly the quantity on which quotation is desired or the approximate quantity on which a quotation per unit is desired. The contractor before calculating or quoting a price on any of the many kinds of goods he manufactures or sells must prepare a quantity survey to determine approximately the quantity he will be required

to furnish. A logical and reasonable procedure, in our opinion, would be for all contractors' organizations to advocate and encourage the introduction of a quantity survey system. This need not be the same as is in force in Europe necessarily, but one adapted to the needs of the construction industry in our country and in which the quantity surveyor practices his profession independently or without any connection or affiliation with any contractors' organization.

In Defense of the System

In defense of the estimating fee system, Howard E. Church, secretary of the General Contractors Association of Cleveland, presented the most complete argument. A letter from Mr. Church, in part, follows:

The most serious indictment it [our editorial] contains of this system is that it increases the cost of construction. The proper preparation of a bid constitutes quite a large item of expense. When bids are solicited from fifteen, twenty, thirty, forty or more contractors on a project, you can understand that if each contractor is submitting a conscientious figure—and if not why should the owner want any figure from him—there is a huge multiplicity of effort and expense occasioned the industry. This cost must be paid by someone, otherwise the contractor would cease to exist. Is it fair for an owner to cause such an added burden to the industry all for his sole benefit, without recompensing the industry for it?

When an intelligent owner, desirous of having a properly constructed building, invites a few responsible contractors to figure he must unfortunately bear a considerable portion of the overhead cost that has accrued to the contractor through the present costly system of bidding, whereas the owner who has taken 30 or 40 bids has not paid anywhere near his share of the cost. Again, it is well known that often an owner or architect will include in a bidding list some irresponsible contractors to whom they have no intention of letting the work; their purpose being to attempt to drive down a responsible contractor to meet the figure of an irresponsible or unscrupulous contractor. Surely any estimate submitted to such an owner by responsible bidders is a personal service rendered for his sole benefit.

Without going into any great detail, two or three of the salient features of a sound estimating fee plan should be mentioned:

1. All the publicity possible is given to the plan. Architects, engineers, contractors and prospective owners are advised of the advantages and criticisms, the amount to be charged, and everything is done in the most open manner.

2. The amount of fee to be included in the estimates is determined after careful study of the cost of estimating the particular job, and in all cases this amount so set up is considerably less than the true estimating cost. This is done to preclude any unscrupulous contractor from preparing a useless estimate in order to earn the fee, yet without any intention of securing the work.

3. One of the main purposes of the system, which you must admit is sound, is the endeavor to cut down the list of the bidders to reasonable proportions. An owner who desires work of good quality will be amply protected by securing bids from five or six reliable contractors.

Under this plan those owners who have been securing large numbers of bids indiscriminately will hesitate when they are paying for same, which is as it should be. The stupendous waste to the industry caused by the great duplication of effort will be largely eliminated. The establishment of such a system will bring increased good will and added repute to the construction industry.

The following arguments are gleaned from a letter from H. J. Gilbertson Construction Co., Memphis:

The estimating fee system as it has been set up, with its nominal rates, does not give the contractor any special compensation for submitting bids. It is merely the systematic adjustment of part of the contractor's cost, distributed properly, so that each project or owner may perforce at the time incurred pay a just share as applying to it or him. The estimating fee system is a matter of insurance that does not penalize the owner, the cost of this item being comparable with the items of fire insurance, compensation, public liability, property damage, etc. It can be considered as an expense item of doing business, and like other insurance should be properly separated near to its actual cost.

Prof. W. G. Geile, associate professor of construction engineering, North Carolina State College of Agriculture and Engineering, stated, in part:

The estimating fee promotes good construction, for it restricts the bidding list to those that the architect has confidence in. It does not materially increase the cost to the owner, for a careful examination of the fees charged will show that only a fraction of the actual cost of submitting a bid is added. I am convinced that the reliable contractors need some sort of protection, and until other plans are devised, the estimating fee as it is now applied is not only a fair but a just fee.

Claim Saving to Owners

Defending the estimating fee system, the *Constructor* stated in its January, 1931, issue:

The primary purpose of the plan is the elimination of useless economic expenses involved in excessive bidding lists and a consequent multiplicity of costs. Such a plan results in savings to the owner and by such savings owners are encouraged to limit their bidding lists to a reasonable number of responsible bidders of comparable ability. No one denies that estimating and bidding a job involves certain expenses on the part of the bidder. It is equally obvious that such expenses must be borne ultimately by the building public as a part of the cost of every job. There remains only the problem of properly allocating this cost with due regard for its point of origin.

Through the operation of the fee plan the owner pays for the service which he gets—no more and no less. The owner who burdens the industry with the economic loss involved in a great number of useless bids pays the cost of his search for a cheap bid. The owner who selects his bidders with care is not taxed with the cost of the other man's folly. He reaps a substantial benefit through exercise of his sound business judgment.

Altogether too long has it been the custom to advise owners to "take all the bids you want—it costs no more and you will get a cheaper price." Responsible contractors have given freely of their services only to be cast aside for the inevitable cheap bidder. Yet owners insist on having bids from responsible firms who know when their bid is submitted that it will not be low. Asking for bids under such circumstances is but a thinly camouflaged request for free consulting service.

The *Constructor* further states that the plan is always operated in the open, is given wide publicity when used and its purpose and methods of operation are explained.

Allege Unfair Practice

Despite the assertions of those backing the system that it is always carried on in the open, above board, with proper publicity and that the idea of submitting complimentary bids to collect the fee is preposterous, two contractors cite experience to the contrary. Both of these firms are operating in territories where the plan seems to have gained a foothold.

One of these contractors, stating reasons why he is opposed to the plan, goes on to say: "We have recently learned of an incident where at least two complimentary bids were submitted on a job to obtain the bidding fee of $200, and of another incident where a real estate company hired a friend for a week to figure a job and gave him the amount of the bidding fee for his work. On this particular job the fee to be added to the cost of the job amounted to $2,000 on work amounting to about $150,000."

The other contractor declared he was very much opposed to the plan and did not want to enter into any agreement to participate. He discussed the system with architects and engineers he had been doing business with for years, and they, along with his attorney, advised against participating in any such scheme. But when he was the only holdout in his territory he declares he was intimidated by subcontractors, surety companies and material dealers threatening ostracism unless he entered into the agreements. Investigating the contentions that the owners and engineers were in full accord with the plan, in two instances this contractor says he found the reverse was true—that the owner and engineer were ignorant of the fact that the system of charging fees was being applied to their jobs and were very much opposed to it when informed of the practice.

Special Master Recommends Limited Diversion of Delaware River Water by New York City

Equitable apportionment among three states advised—New York's share cut to minimize damage from reduced flow

THAT THE diversion, under suitable restrictions, of the equivalent of 440,000,000 gal. per day (440 m.g.d.) of water from tributaries of the Delaware River for domestic use in New York City should be permitted by the U. S. Supreme Court is the conclusion reached by Charles N. Burch, special master, in a report submitted to that body on Feb. 2. The special master was delegated by the court on Jan. 27, 1930, to take evidence in the suit of the State of New Jersey vs. the State and City of New York (Commonwealth of Pennsylvania, intervenor), to make findings of fact and conclusions of law, and to propose a decree.

The suit was instituted by New Jersey on May 22, 1929, to enjoin the proposed development, by New York City, of certain tributaries of the Delaware River lying wholly within New York State as an addition to the water-supply system of the city. Such development, it was charged, would result in irreparable injury to New Jersey and its citizens in the following specific particulars: (1) By reducing the navigable capacity of the river; (2) by depriving riparian owners of their natural right, under the common law, to the unobstructed and undiminished flow of the river; (3) by reducing potential waterpower development; (4) by injuriously affecting the sanitary condition of the river; (5) by injuriously affecting the industrial uses of the river water; (6) by injuring the oyster industry through an increase in the salinity of the water; (7) by injuring shad fisheries; (8) by affecting municipal water supplies along the river; (9) by lowering the river level, to the detriment of agriculture along its banks; (10) by interfering with recreational use of the river. In addition, New Jersey maintained that other sources of supply for New York City were available which would not involve interstate waters; that the city uses its present supply in a wasteful manner; and that the proposed plan would result in violations of federal laws respecting power development, navigation and the taking of property without due process of law.

The defendants entered a general denial of these allegations, particularly in respect to any injurious effects of the proposed diversion. The fact was admitted that plans had been prepared for the diversion from the Delaware River watershed, of the equivalent of 600 m.g.d., but is was maintained that execution of the plan would be beneficial rather than injurious, as the substantial effect would be to lower flood crests and to release from the storage reservoirs sufficient water to maintain a minimum flow of 0.45 sec.-ft. per square mile from the storage watershed throughout the summer and during dry days throughout the entire year.

Pennsylvania intervened in the suit to safeguard its own interests. The commonwealth did not oppose the diversion of 600 m.g.d. by New York, considering this amount as within the fair and equitable share of that state in the waters of the upper Delaware, provided proper safeguards were imposed to prevent damage to the interests of the commonwealth or its citizens. Pennsylvania's position was outlined as follows:

1. The waters of the Delaware and its tributaries should be equitably apportioned among the three states.
2. Eastern Pennsylvania, including the city of Philadelphia, should be alloted 750 m.g.d. of this water for future needs.
3. Any present allocation to New York should be charged against its equitable share, and not be considered as a prior appropriation.
4. Release of water from New York's storage dams should be regulated so as to maintain a certain minimum flow in the main river, rather than be determined by conditions on the storage watershed.
5. A river master should be appointed to supervise and control the impounding and release of water.

Details of the Plan

New York has planned its development in three stages, as detailed in *Engineering News-Record*, Aug. 11, 1927, p. 218. The first and second, covering the Neversink and the East Branch, would provide 440 m.g.d. This part of the development is approved by the special master. The third stage, which is not granted, would include the Little Delaware, the Willowemoc and Beaver Kill, adding 160 m.g.d. to the yield. Rondout Creek, a part of the project which does not enter into the present suit, would yield an additional quantity of from 70 to 100 m.g.d. Construction of the first stage would also make possible turning the yield from higher parts of the present Croton drainage area into existing Catskill terminal reservoirs, conserving head now wasted.

Estimated costs on the basis of complete development for the first two stages are summarized as follows:

East Branch reservoir	$40,858,000
Neversink reservoir	7,210,000
Rondout reservoir	26,387,000
Tunnel, East Branch to Rondout	21,555,000
Tunnel, Neversink to Rondout	885,000
Tunnel, Rondout to West Branch	78,859,000
Constructions on Croton watershed	8,764,000
Tunnel, West Branch to Kensico	34,155,000
Control works, Kensico	8,494,000
Aqueduct, Kensico to Hill View	43,049,000
Aerator and connections, Kensico	644,000
Gate house and connections, Hill View	1,727,000
Total	$272,587,000

These estimates were prepared on the basis of ultimate development of all three stages.

Findings of Law

All three of the states involved in the suit maintain, with certain exceptions not pertinent to the present case, the rule of common law with respect to riparian rights. This is summarized in the statement that the riparian owner has the right to enjoy, without substantial diminution or alteration, the natural flow of the stream past his property. Strict interpretation of this rule would forbid any diversion of water from the Delaware system for use in New York City, from which point it would never be returned. However, the master believes that, in a case of such importance, the court should not confine itself to the common law alone, but should also give consideration

to the statute laws and public policies of the three states and to principles of what may be termed "interstate common law," a code which has been built up by the courts to govern relationships among states.

Of unusual interest are the conclusions reached by the special master in regard to the objections of New Jersey respecting the alleged wasteful use of New York City's present water supply and the availability of other supplies not involving interstate waters. New Jersey argued that, before being permitted to resort to the tributaries of the Delaware, the city should be required to conserve water by a system of universal metering and by charging adequate rates, and also that it should first exhaust other possible sources not affecting interstate streams. These contentions are held to be not without merit; however, the master finds that universal metering would be extremely expensive, would, at best, do no more than to defer the necessity for more water for approximately five years, and that the present per capita use of water in the city is not excessive. In the matter of other supplies he finds that unless the matter be one "where it is clearly shown that the defendant city and state are wilfully, arbitrarily or without any substantial or sound reason" resorting to the Delaware, instead of to other sources, the matter is one of internal administration in which New Jersey has no right to intervene. New York's reasons for resorting to the Delaware—purity and high elevation—are held to be sufficient to nullify this objection on the part of New Jersey.

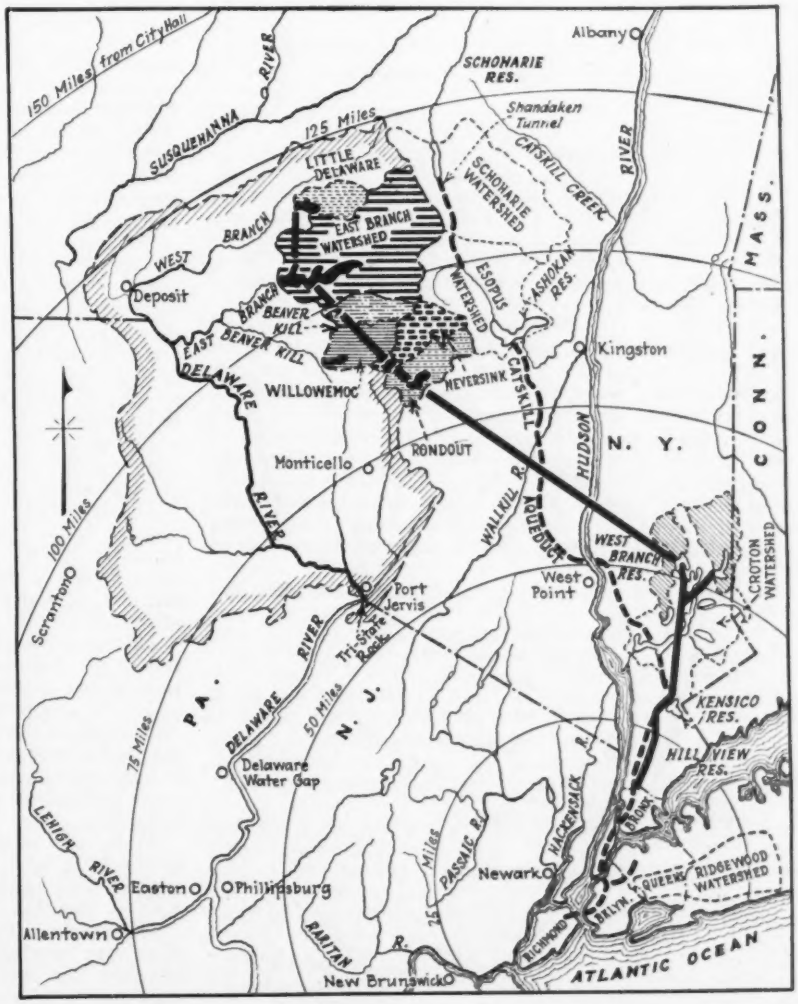
Furthermore, the master finds that all three states do permit diversions by municipalities for domestic use, and that diversions from one watershed to another are not unknown. Among the many examples cited are included the Delaware and Raritan canal and the Morris and Essex canal, both in New Jersey, which have been permitted to divert water from the Delaware without returning the full amount to that watershed. Furthermore, he finds that there is much latitude in the word "substantial" as applied to permissible diminution of flow under the common-law rule. These and other considerations lead him to the conclusion that a diversion of water by New York City for domestic use would not necessarily be illegal; the question is one of degree rather than of principle. New York should neither be permitted to inflict injury upon New Jersey and Pennsylvania by too great a diversion nor be deprived of its fair share of the benefits to be derived from utilization of the river.

Findings of Fact

Consequently the special master is called upon to determine the effect of the proposed diversion plan upon the river and the amount of damage, if any, which would result from its execution. Expert testimony on these points, much of which was contradictory in nature, was introduced in considerable volume by all three states. Each of the specific objections to the plan made by New Jersey was examined in turn, and a separate conclusion as to fact is set forth in the report. Summing these together, the master finds that although no single item of damage which would be incurred by New Jersey on account of the execution of a 600-m.g.d. diversion would be serious or substantial, the total of all such items indicates damage to an amount greater that that state should be required to suffer.

However, the master finds such injury can be abated by (1) reducing the volume of diversion; (2) modifying the plan of releasing water from the impounding reserviors during low stages of the river; and (3) treating industrial and sewage wastes at Port Jervis.

Of Pennsylvania's contentions the master approves three: that the river water should be apportioned among the three states; that the present diversion shall constitute part of New York's allotment, not a prior appropriation;



Present and proposed sources of water for New York City

Central shaded areas are watersheds which the city proposes to develop. Five of these now drain into the Delaware River; the sixth, the Rondout watershed, is within the Hudson River drainage area. The special master approves the use of East Branch and Neversink supplies, but not interference with the Little Delaware, Beaver Kill or Willowemoc. Shaded areas on the right are high parts of the Croton watershed which could drain into the proposed high-level aqueduct

and the Pennsylvania plan of releases rather than that approved by New York.

Accordingly, the report as submitted recommends that the Supreme Court issue a decree embodying the following points:

1. Denying New Jersey's request for an injunction restraining the state and city of New York from diverting any water whatever from the Delaware watershed.
2. Denying New Jersey's request for an injunction restraining New York from diverting the equivalent of 440 m.g.d. to the water supply system of New York City.
3. Granting New Jersey an injunction restraining any diversion in excess of the equivalent of 440 m.g.d.
4. Imposing the following conditions on the 440 m.g.d. diversion: (*a*) Sewage from Port Jervis shall be treated so as to effect a reduction of 85 per cent in organic impurities. The effluent from the treatment plant shall be treated so that the B. coli originally present in the sewage shall be reduced by 90 per cent. Industrial wastes shall be treated so as to render the effluent practically free from suspended matter and non putrescent. Necessary plants shall be erected and maintained by New York as long as the diversion continues. (*b*) At any time the stage of the Delaware River falls below 0.50 sec.-ft. per square mile at either Port Jervis or Trenton (equivalent to flows of 1,535 and 3,400 sec.-ft. at these two points) impounded water shall be released in sufficient volume to maintain the flow at this figure. However, no quantity in excess of 30 per cent of the yield of the diversion area (0.66 sec.-ft. per square mile) need be released at any time. For the purpose of determining the flow at Port Jervis the Neversink River shall be considered to flow into the Delaware above that city. (*c*) New Jersey and Pennsylvania shall have the power to inspect all parts of the diversion system, as well as records, at any time.
5. Providing that this diversion shall not constitute a prior appropriation.
6. Denying, without prejudice, the application of Pennsylvania for an allotment of 750 m.g.d.
7. Denying, without prejudice, the request of Pennsylvania for the appointment of a river master.
8. Providing that the decree shall not affect the paramount authority of Congress and the war department in respect to navigation.
9. Providing that the cause shall be retained in court so that any party may apply for necessary modification in the future.
10. Defining the exact meaning of the allowable diversion of "the equivalent of 440 m.g.d."
11. Providing for the division of costs as follows: State of New Jersey, 35 per cent; city of New York, 35 per cent; State of New York, 15 per cent; Commonwealth of Pennsylvania, 15 per cent.

LETTERS TO THE EDITOR

A Forum for Expression of Views by Engineers and Contractors

✦

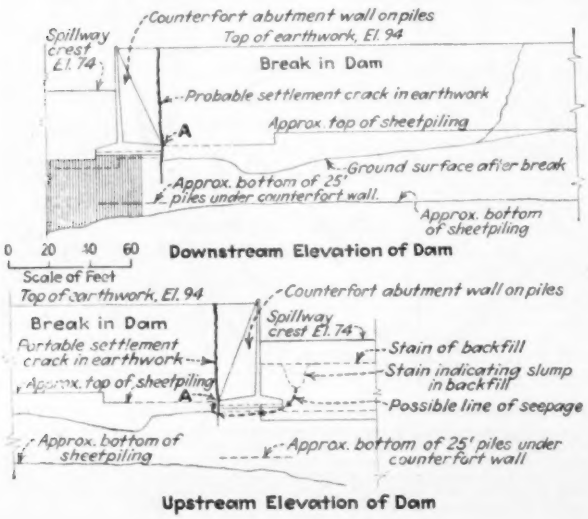
The Corpus Christi Dam Failure

Sir—I am in hearty agreement with the editorial in *Engineering News-Record* of Dec. 18, 1930, p. 952, which says: "Pending the official report of the board of engineers which is now investigating the failure of the Corpus Christi dam, positive opinion as to causes and responsibility may properly be held in abeyance."

The following is a suppressed sporting desire to point out what appears to me to have been the probable cause of the failure of the Corpus Christi dam. No bets will be accepted.

In the description of the failure are given, among others, two probable contributing causes that become significant when taken in conjunction. The first is the presence of stain, indicating a crater-like slump in the backfill on the reservoir side of the spillway about 5 ft. from the north abutment wall. The second is the suggestion that unequal settlement of the earthfill on compressible soil and the adjacent abutment on more rigid foundation might produce a line of weakness.

In support of this last suggestion, the writer has had experience of settlement in a trench fill through the upstream portion of an earth dam where the suddenly rising floodwaters following a heavy rainfall settled the less compacted fill in the trench and opened waterways along the sides of the trench, flooding the core area but doing no other damage.


Counterfort abutment wall on piles
Spillway crest El. 74
Top of earthwork, El. 94
Break in Dam
Probable settlement crack in earthwork
Approx. top of sheetpiling
A
Ground surface after break
Approx. bottom of 25' piles under counterfort wall.
Approx. bottom of sheetpiling
0 20 40 60
Scale of Feet
Downstream Elevation of Dam
Top of earthwork, El. 94
Counterfort abutment wall on piles
Break in Dam
Spillway crest El. 74
Probable settlement crack in earthwork
Stain of backfill
Stain indicating slump in backfill
Approx. top of sheetpiling
A
Possible line of seepage
Approx. bottom of sheetpiling
Approx. bottom of 25' piles under counterfort wall
Upstream Elevation of Dam

In the fifteen to eighteen months that the Corpus Christi reservoir had been filled there had been sufficient time for uneven settlement to take place along a cross-section of the embankment at the edge of the footing of the counterfort wall, as indicated in the accompanying sketch. This settlement would be a maximum under the higher portion at the center of the embankment over the steel sheetpiling.

Settlement in rolled-fill dams as ordinarily built is in excess of that of hydraulic fills. At the Corpus Christi dam the settlement of the fill resting on the abutment footing would be strictly limited to the depth on the footing, while beyond the footing it would be augmented by settlement of underlying material. Had the abutment wall been of gravity section, the settling earth would have compacted increasingly against the the sloping back, instead of settling unevenly at the edge of the counterfort footing.

The writer does not recall an instance of a wall of this type, supported rigidly on piles, as an abutment to retain the embankment of an earth dam on yielding ground.

The supporting piles of the abutment wall prevented subsequent compacting of material underneath it. The bond between earth and underside of wall would not increase after the concrete of the wall had set. On the other hand, the presence of water after filling the reservoir would cause settlement of earth away from the concrete.

There was no cutoff sheetpiling under the upstream portion of the abutment. The travel of seeping water from the back of the spillway near its junction with the abutment, under the abutment, and by way of a very probable settlement crack in the embankment, over the steel sheetpiling at the point *A*, and out by the way of the crack, was short. That it took this course in the early stages is substantiated by stains on the back of the spillway, indicating a slump in the backfill.

At the time of the break there was a hydrostatic head of nearly 20 ft. with stilling pool full and about twice that if the pool were nearly empty under the condition of 1 in. overflow, as recorded.

The simple statement of the fisherman on the dam, that there was swirling above the abutment and boiling below, indicates that considerable water was moving through the dam, and the cracking away from the wall fixed the place of movement close to the wall.

That the same type of failure may be repeated at the south abutment is probable unless measures be taken to avert it before the reservoir is again filled. J. ALBERT HOLMES.

Somerville, Mass.,
Jan. 2, 1931.

Sir—The writer and his associates have read with considerable interest the description of the Corpus Christi dam failure appearing in *Engineering News-Record* of Dec. 18, 1930, p. 974. Our attention was particularly called to the striking resemblance, in both type of design and soil conditions, between this structure and some with which we have been connected. Obviously, we were interested in discovering, from a careful reading of the article, an explanation for the failure.

You speak of this being "one of the boldest dam designs ever constructed" on account of its height on piles in sand and "the unusual dished base contour for a gravity section weir." The writer would suggest that the "boldest" feature was the placing of the footings of the end retaining walls 15 ft. above the bottom of the spillway apron, and above normal tail-water.

One of the chief difficulties in connection with dams and power houses supported on piles in sand is to retain the sand. The construction cannot be made absolutely watertight. Some water will leak through. But if this water constantly carries with it small quantities of sand ultimate failure may occur. Nor is there likely to be any indication of sand leakage, as in the case of clayey soils where discolored waters are a danger signal.

Such a sand leakage ordinarily follows through a structure along or under plane surfaces. Natural drains are developed, through which the fine sand particles are transported downstream and out from under the structure. Such drains start at the downstream edge of the concrete and develop to a size that will carry off the leakage at a velocity too low to transport further sand. At this point the condition may be stable; providing the upstream cutoff is capable of preventing a blowout.

The writer's firm, a few years ago, rebuilt a small dam and power house in northern Michigan, which had been in service for about fifteen years, and which, with almost no warning, was undercut and dropped into its hole in about fifteen minutes after the first signs of failure were noted. Judging from the wreckage, this structure had been built on piles with a wooden sheetpiling cutoff. The material was a fine beach sand. The fact that it stood so long and failed so rapidly suggests that a leakage through imperfect sheeting, no doubt small at first, permitted the sand to be slowly carried away from downstream to the upstream cutoff until a free passageway for water had been provided, and a sudden failure or undercutting of the sheetpiling permitted the lake above to pass readily through the opening, with consequent disaster.

Such a drain as the writer describes could have developed, it would seem, under the Corpus Christi dam along the plane under-surface of the retaining wall downstream of the sheetpiling. Here was a comparatively smooth surface, originally in contact with sand and above tail-water. If the sand at the downstream end of this wall could have slowly gotten away, as appears probable from the description, there would have been developed gradually an excellent drain, which would slowly work its way upstream to the sheetpiling. Having reached the sheetpiling, this drain would have been separated from the water in the pond by another smooth surface at right angles to its path and of a length equal to only the width of the footing. The slump in the stain of the backfill suggests that the material settled slowly at this point, passed under the footing along the face of the sheetpiling, up over the top of the sheeting and out of the drain above described. Just preceding failure, judging from the description of the actual break, probably a considerable flow had developed along this path before the material in the embankment immediately above caved in and was washed out.

Some suggested modifications in design that might have avoided this disaster are:

1. A retaining wall set with its foundation deeper, certainly below tail-water, and with a downstream cutoff to prevent the outflow of material.

2. Collars or ridges on the bottom surface of the wall to prevent free flow and the development of a drain along the under surface thereof.

3. A corewall for some distance into the bank back of the retaining wall, to lengthen the passageway from the pond, or

4. An additional line of sheetpiling driven upstream along the edge of the retaining wall footing, on the pond side, also to lengthen the leakage path for the water.

5. Adequate drainage of the downstream half of the embankment through carefully placed tile drains. A lowered hydraulic gradient on the downstream side of the embankment would have reduced the head, tending to produce flow under the wall footing.

Of the above suggestions a combination of 1 and 5 would probably have been the writer's choice had he been responsible for the design.

Obviously, it is easy to make these suggestions after a failure. Their necessity in the original plans might not have been so apparent. The failure of the structure should, however, prove a valuable object lesson to designers, to wit: that where there is sand under a dam every precaution must be taken to retain it. Passageways through which it may leak out and short cuts through which it may be blown out by the water pressure must be avoided.

LOUIS E. AYRES,
Consulting Engineer

Ann Arbor, Mich.,
Jan. 6, 1931.

Wichita Falls Dam Correction

Sir—A. C. Eaton has called my attention to a mistake in my plotting of the line representing the core material of the Wichita Falls dam on Fig. 3, p. 965 of your December 18, 1930, number. The sizes indicated by the line are one-tenth as large as the correct sizes, which are somewhat larger than for average core material. This correction does not materially alter the conclusions, as the idea that the size of particle may not be the only factor in the rate of consolidation is indicated by evidence not discussed in the article. It strengthens the conclusion that, with our present knowledge, cores of very fine material should be guarded against. The limit of particle size of safe core material is probably slightly smaller than that of the Taylorsville Dam (line No. 9).

E. W. LANE,
Hydraulic Engineer.

Denver, Colo.,
Jan. 5, 1931.

Multiple-Span Suspension Bridges

Sir — Mr. Kuester's recent article and your excellent editorial on the subject of multiple-span suspension bridges, *Engineering News-Record*, Jan. 15, 1931, p. 102, are pointedly interesting. For the purpose of the record, it would seem appropriate to give credit for the conception of the idea and the development of the detail studies to the late Louis R. Ash.

Mr. Ash devised this type of structure without contact with the previous work of others, and Mr. Kuester was one of the engineers in our office who carried out calculations and other work in the development of the ideas, under Mr. Ash's personal direction. Mr. Kuester was engaged for a number of months in these calculations, later making home studies, and his excellent mathematical training and ability were highly valuable and fully appreciated. The method of ending the cables at the tops of the towers and other details were all worked out by Mr. Ash, or under his direction. Following full investigations by Mr. Ash, including the testing of a 40-ft. model, the complete detail designs and plans for a large bridge of this type were undertaken and finished, but actual bridge construction was delayed for financial reasons.

Mr. Ash made application for patents on this type of structure in 1928 and later learned that a similar application had been filed almost coincidentally by D. B. Steinman. Both were later advised of the early French designs.

Mr. Ash had been planning to make personal preparation of material on multiple-span suspension bridges for publication for the profession, but his death occurred before it was done.

E. E. HOWARD,
Ash-Howard-Needles & Tammen

New York City,
Jan. 24, 1931.

New Jersey Joint Outlet Sewer Being Duplicated

Sixteen miles of sewer and disposal work under construction by eleven municipalities organized as Joint Meeting

By EDWARD S. RANKIN

Secretary Joint Meeting in the matter of an outlet sewer for certain municipalities in Essex and Union Counties, N. J.

WORK is well advanced on the construction of a second joint outlet sewer to tidewater for a number of municipalities in the valleys of the Elizabeth and Rahway rivers, New Jersey. The project itself is of less significance than the governmental machinery devised three decades ago to carry it out, since adopted by two other groups of New Jersey municipalities and now being used for the second time by the group which originated the plan. It is known as the Joint Meeting, for the reason described later in this article. This administrative machinery was a novelty at its inception and is different in some respects from that of most of the sewer districts now becoming common in various states.

Some 30 years ago the village of South Orange, feeling the necessity for installing a system of sewers, cast about for a satisfactory method of disposal. An independant outlet to tidewater was prohibitive on account of the cost, South Orange lying some 12 to 15 miles from the nearest available tidewater without pumping. The discharge of raw sewage into the branch of the Rahway River, which flows through the village, even in those days of liberal sanitary laws was recognized as impossible, and the attempt to locate a treatment plant in a neighboring municipality was blocked by legal action. At this point the proposal was made and accepted by a number of the neighboring municipalities to unite in constructing a joint outlet to salt water. The necessary legislation, known as the "joint sewer act of 1899" was secured and a contract executed by seven municipalities in Essex and Union counties, looking toward the construction of such an outlet.

Alexander Potter, of New York, was selected as the engineer, plans were drawn, contracts let, and the sewer put in operation early in 1904. The tributary population was then about 50,000.

Briefly, the law above referred to provides that any two or more municipalities in the state may jointly construct, and thereafter maintain and operate an outlet sewer. After surveys, plans and estimate of cost are made a copy must be sent to the clerk of each municipality interested, together with a statement of the percentage of cost to be paid by each. After due consideration by the governing bodies a resolution is passed, signifying the intention of the municipality to join in the enterprise. A copy of this resolution must be filed with the clerks of all the other municipalities.

These formalities completed, "it shall be lawful for any two or more of the municipalities so adopting such resolution—to thereupon respectively authorize, by an ordinance duly passed, the making and entering into, by and on behalf of such municipality respectively, of a joint contract with such other municipality or municipalities as may then or thereafter desire to unite for the building and constructing, operating and maintaining of such outlet or trunk sewer. . . . "

After the execution of the contract and the filing of same with the county clerk, the boards in charge of the construction of sewers in each municipality proceed to organize in joint meeting by the election of a permanent chairman, secretary, treasurer and such other officers and agents as they may deem necessary. This organization continues until the completion of the work, when it is reorganized into a maintenance body.

The Joint Meeting so organized has authority to make contracts for the construction of the sewer, the right to purchase or condemn rights-of-way through their own or outside municipalities, and to assess the costs back on the municipalities in the percentage specified in the contract.

Theoretically, every member of every governing body is a member of this Joint Meeting, but practically it has worked out that each governing body appoints one of its members to represent it and conduct the business of the meeting. Each member has an equal vote regardless of the capacity taken.

The strength of the law lies in the fact that everything is entirely voluntary. No municipality is compelled to go into the scheme, such action being taken solely because it considers it to be for its best interest to do so. The capacity taken in the sewer is determined by each municipality for itself and may or may not be the capacity recommended for it by the engineer. The cost of each is in direct proportion to the percentage of capacity in that part of the sewer used by it, which capacity is the absolute property of the municipality contracting for it and may be used, sold or leased to other municipalities.

Perhaps there is no better proof of the satisfactory working of the law than the fact that when it became known that the sewer then constructed was to be enlarged, five new municipalities asked to be admitted to the project, so that the new Joint Meeting consists of eleven municipalities, one of the original seven having been absorbed by Newark. The eleven are the cities of East Orange, Newark and Summit, the towns of Irvington and West Orange, the townships of Hillside, Maplewood, Millburn and Union, the borough of Rosedale Park and the village of South Orange. Two other Joint Meetings are now operating, one composed of seven municipalities in the Second River Valley in Essex County and the other of nine in the Rahway Valley in Union County.

Within fifteen years after the completion of the first joint outlet the unprecedented growth of the district served by it required more outlet capacity. In 1922 Mr. Potter advised the construction of a parallel sewer to provide for an estimated population of 426,000 in 1960. The present population of the district, according to the 1930 census, is 243,000.

Work was begun in the summer of 1927 but due to unavoidable delays in securing a right-of-way and a site for the treatment plant, the lower half of the sewer is not yet built.

When completed, the sewer with its branches will be approximately 16 miles in length, extending from Summit and West Orange as the extreme north and west points, to the Arthur Kill near the south boundary of Elizabeth. In size, the sewer will range from 27 in. to the equivalent of 9 ft. in diameter.

The treatment plant will consist of screens and three rectangular sedimentation tanks designed for four hours detention, in accordance with the regulation of the state department of health. Sludge will be removed by machinery and barged to sea. The estimated cost of the sewer and treatment plant complete is about $5,500,000.

Canadian Engineers Meet in Montreal

Engineering Institute of Canada holds its 45th annual session — Civil engineering subjects predominate

Engineering News-Record Staff Report

WIDE INTEREST in professional as well as in technical matters was evident at the 45th annual meeting of the Engineering Institute of Canada, held in Montreal, Feb. 4-6. It centered chiefly around a movement to make the membership requirements of the various provincial associations of professional engineers the same as those of the Institute in order to put all engineers in Canada on a par as to basic requirements to practice. The movement corresponds to the uniform registration law movement in this country, but in Canada there are no registration laws, the provincial associations being authorized by law to set up the basic qualifications for the practice of engineering. The Canadian movement is regarded in some quarters as a preliminary to bringing all members of the provincial associations into the Institute, which is to give them technical service and their local associations professional service. This subject was discussed by S. G. Porter, the new president of the Institute, at the opening session.

The retiring president, A. J. Grant, took as the subject of his address "The Great Ship Canals of the World." The paper describes the Panama, Manchester, North Sea, Kaiser Wilhelm, Suez and Welland canals, and includes a comparison of the principal dimensions of the first six to those of the Welland Canal, of which Mr. Grant is engineer-in-charge.

Medal Awards

Among the prizes presented at the opening session were two awards of the Gzowski medal, one to F. M. Wood for his monograph on nomography, and the other to P. B. Motley for his paper on the reinforcement of Stoney Creek arch bridge. The Sir John Kennedy medal, the highest distinction in the gift of the Institute, was awarded to George Herrick Duggan, president of the Dominion Bridge Co. and a past president of the Institute.

Civil engineering subjects predominated at the technical sessions held Thursday and Friday, and only the papers and discussions in that field are noted in the following report.

Concrete Formwork at Chute à Caron

Two hydro-electric power developments were the subject of a major part of the technical discussions on Thursday—the Chute à Caron project on the Saguenay River in Quebec, and the Camp Alexander development on the Nipigon River in Ontario. C. P. Dunn, chief engineer of the Alcoa Power Co., described the method used in laying out warped surfaces in the hydraulic structures at the Chute à Caron plant. The method is not new, according to Mr. Dunn, but is simply an adaptation of the methods used by ship builders in shaping the hull of a ship. It is a cut-and-try method in which rough sketches of the elements of curved surfaces approximately satisfying the hydraulic conditions to be met are adjusted until they will produce a surface closely approaching the ideal surface, namely one in which the trace of a plane cutting it in any direction is a smooth easy curve. Such a curve need not be one which can be defined by a mathematical equation.

The results at Chute à Caron have shown that this system not only produces hydraulically correct surfaces but also surfaces which materially simplify the formwork.

Closely allied to Mr. Dunn's paper was one by I. E. Burks, describing the method of placing concrete on steep slopes and warped surfaces of the Chute à Caron dam, without the use of surface forms. Surfaces on the face of the spillway with slopes as steep as 50 deg. were finished off without top forms. This operation was made possible only by the very stiff mix of concrete employed on the Chute à Caron project. Screed guides were set up for the sloping or warped surfaces, supported on 2-in. pipe set in the concrete of a preceding lift, the screeds being so placed that their *bottom* surfaces represented the finished surface. The stiff concrete, in 4-yd. batches, was deposited behind the screeds and worked out to approximately the finished surface with electric vibrators and shovels. Men with straight-edges dapped to fit over the screeds followed, and finally the surface was finished off with floats. A smooth dense surface was produced in this way at a considerable saving in form costs and in time and at a lesser saving in cement.

Diversion Canal at Chute à Caron

A third paper on the Chute à Caron project described the diversion canal and sluice through the power house. It was presented by G. O. Vogan, chief designing engineer of the Alcoa Power Co. Mr. Vogan prefaced his remarks with a description of the method employed to divert the river into the new channel by tipping of a great concrete obelisk into a narrow part of the channel, a scheme devised by James W. Rickey, chief hydraulic engineer of the Aluminum Company of America. Motion pictures of that operation were shown, also of the diversion channel below the power house when carrying quantities of water up to 45,000 sec.-ft. In order to handle these large quantities of water out through the lower end of the diversion channel, which is to be the tailrace of the completed plant, without destructive eddies very complete model tests, on a scale of one-eighteenth full size, were made to determine where the hydraulic jump would occur under varying conditions of flow.

The Alexander Project

The other hydro-electric plant to be discussed was the Alexander project on the Nipigon River, the second plant to be built on that river by the Hydro-Electric Power Commission of Ontario. T. H. Hogg, chief hydraulic engineer of the commission, described the plant.

The most interesting feature of the Alexander project is the earth dam used to close off the river and divert it from its course. The river, at the point of diversion,

ran in a narrow channel flanked by rock on both sides, and, in the early studies, a concrete dam was assumed to be the most desirable; but borings showed the valley to be a gorge filled with glacial deposits to an unknown depth. The condition of the glacial material, largely lenzes of sand and gravel, seemed to indicate that an earth dam, supplemented by a blanket of clay upstream, would give the safest and tightest job. As built, the dam is a semi-hydraulic fill with a heavy rock fill at the downstream toe. The upstream blanket was obtained by jetting down leader clay from the banks. When saturated with water that material will flow and spread on the bottom of a still pool like a viscous fluid. This peculiar advantage of the leader clay in making a blanket on the river bottom was pointed out by W. S. Lee in the active discussion which followed the presentation of Dr. Hogg's paper.

Another interesting feature of the project is the design of the concrete abutments for joining earth and masonry structures, a recognized weak point. The abutments at the Alexander project are U-shaped and have no vertical faces; all are sloped so that as the earth settles it is pressed into contact with the concrete.

Breakwater Construction

Methods used in the construction of the breakwaters at Port Arthur, one of the twin grain ports at the head of Lake Superior, were described by F. Y. Harcourt, district engineer, Department of Public Works of Canada. Breakwaters were first built there in 1886 and were of timber on rock-filled cribs, part of which still remain. Modern structures are of two types, concrete-capped rock-fill cribs on timber piles, and rubble mounds of quarry-run stone capped with an armor course of random stone, 4 to 6 tons or over in weight. No particular difficulties were involved in the construction of the former type, but in the latter, settlement into the soft clay (which overlies the rock to depths of about 40 ft.) has caused much trouble. Occasionally, sudden settlements have endangered the floating construction plant. In the development of the mound type it has been found that an irregularly laid armor course is more efficient in breaking up waves and withstands the suction of retreating waves better than regularly laid stone. Ice fields, in the author's opinion, do more damage than waves.

Ferry Landings and Canal Gates

The new train ferry landings, for the transshipment of railroad cars from Port Mulgrave in Nova Scotia to Point Tupper on Cape Breton Island were described in a paper by D. B. Armstrong and W. Chase Thomson, of the Dominion Bridge Co.; and the construction of the steel lock gates at the Welland Canal was described by E. S. Mattice, vice-president of the National Bridge Co. The train ferry landings are of special interest because of the devices employed to meet variations due to the list of boats, variations of draft and a tidal range of 7 ft.

Mr. Mattice's paper was devoted entirely to fabrication and construction problems encountered in the Welland Canal gates, thus supplementing the paper on the design of the gates presented at the Institute's meeting in 1928 by F. E. Sterns. Experience gained in construction of the gates has shown that certain refinements taken to obtain watertightness in the gates themselves were unnecessary; while on the other hand, it was found that other refinements, such as the milling of ends of frames, would have been economically justified.

Among the geological papers presented was one of interest to civil engineers. It treated of the water-supply problems of Southern Saskatchewan, a wide area of prairie land almost entirely dependent upon groundwater for its domestic supply. The paper was by W. A. Johnson of the Canadian Geological Survey.

Sun Life Building

Six papers were devoted to various engineering aspects of the new Sun Life Assurance Co. building in Montreal. A. H. Harkness, consulting engineer, Toronto, described the structural features. They are of special interest because the building is an enlargement of the former building in which the reinforcing of numerous columns and the strengthening of column footings was required.

The enlarged building, now nearing completion, occupies an area of approximately two acres, and its central tower, 171x240, rises to a height of 400 ft. The structural frame contains 18,550 tons of steel, or approximately the same as the Chrysler Building in New York. Its cubical content is 22,000,000 cu.ft.

The original building, occupying about one-third of the lot occupied by the new building, was designed to be sixteen stories high, but was only built to a height of eight stories. In the new building the central tower, which rises to a height of 24 stories, overlaps the old structure, making it necessary to reinforce three lines of columns along one side of that building. The footings of these columns also had to be enlarged. Before enlargement was undertaken excavation in the adjoining area to a level below them revealed that the supposedly solid rock upon which some of them rested actually was but a thick upper stratum separated from the underlying rock by a thin stratum of clay. This required that the footings be carried down to a greater depth during the process of enlarging their bearing area.

Another structural feature of interest in the Sun Life Building was the large number of offset columns made necessary by the joining of the old and new structures and by architectural features. Batter columns were used in a number of instances, and where the offset of pairs of columns was symmetrical no diagonals were put in, it being assumed that the building was sufficiently rigid to provide for horizontal reactions due to unbalanced column loading.

Friday afternoon a large party of Institute members and guests visited the Sun Life Building. Other smaller parties visited the new Back River hydro-electric station of the Montreal Island Power Co., the Dominion Engineering Works, the shops of the Dominion Bridge Co., the new Marconi factory, the new refinery of Canadian Copper Refiners, and the new Point St. Charles shops of the Canadian National Railways.

About 550 members and guests attended the meetings.

California Registers 5,000 Civil Engineers

Applications for licenses under the new California civil engineers' registration act reached 5,700 during the first year that the board of registration functioned, although the board had expected only about 2,500 applicants. Of those applying, slightly more than 5,000 have been registered; this number makes a ratio of about one registered civil engineer per 1,000 of population in the state. The board intends to carry on some research work in the future to determine trends in engineering employment and may recommend a reduction in the number of engineering graduates.

NEWS OF THE WEEK

Two Cities Destroyed In New Zealand by a Series of Earthquakes

A SERIES of earthquakes visited New Zealand during the week of Feb. 2, practically destroying the town of Hastings and the city and harbor of Napier. The surrounding districts also suffered severely. Martial law has been declared in Hastings and no one is permitted to enter the business district without a permit, for fear what is left of the buildings may collapse. The official estimate of the dead in Hastings is more than 100. Napier, which also has a large death list, was ruined, the water supply and sewerage systems were destroyed, and the town was ordered to be evacuated.

According to newspaper accounts, the first shock occurred in the morning of Feb. 3 and the second ten hours later. Succeeding shocks came during the rest of the week. Fire followed the first shock.

Napier, a town of about 20,000 inhabitants, has a wide beach and is one of the most popular holiday resorts of New Zealand. The business portion of the town is on a low plain only a few feet above sea level. Its harbor is not a natural one, and extensive improvements have been under way to enlarge the facilities for handling ship traffic. Napier has a fine inner harbor sheltered from the open sea by a tongue of land that forms a natural breakwater, leaving only a passage several hundred feet wide through which ships enter and leave, and the improvements that were in progress consisted of additional dredging in the inner habor and deepening the entrance channel.

An airplane survey of the earthquake district shows that in a distance of 80 miles not a single river enters the sea by its former mouth. In some places the shore line has risen 40 to 50 ft. and near Napier a cliff which formed the shore line has fallen into the sea.

Bids to Be Called on Golden Gate Bridge Construction

Bids for all the major construction features of the Golden Gate Bridge will be called for during April and May and will be opened on June 1. Announcement of this plan was made by the directors of the Golden Gate Bridge and Highway District following their acceptance of the recommendations made by the chief engineer and the consulting board. The first call will include bids for the substructure for the main bridge, which will require three separate bids: (1) the two main piers; (2) the two anchorages; (3) a bid on the two items combined.

The steel superstructure will be included in item 2, on which three bids will be called: (1) the cables, suspenders and anchorage steel; (2) towers, stiffening trusses, floor system, steel approaches and all other steelwork between the anchorages; (3) a bid on the two items combined.

Item 3 will be the bids for the two approaches: (1) the Presidio road, including viaducts and accessory structures; (2) the Sausalito road, including viaducts and accessory structures.

All miscellaneous construction will be included in item 4, which will be let in six contracts: (1) paving of roadway floor of main structure and to the plaza; (2) the railing on the main structure; (3) lighting; (4) toll houses and plazas; (5) final painting coat; and (6) incidentals.

In order to allow ample time for coordination with the issues of the bonds, it is recommended that bids be asked for item 2 on April 1, item 1 on April 15 and item 3 on May 1, all of which will be opened on June 1. Bids will not be called for on item 4 until a later date, but an estimate of the cost of construction included in this item will be submitted on June 1.

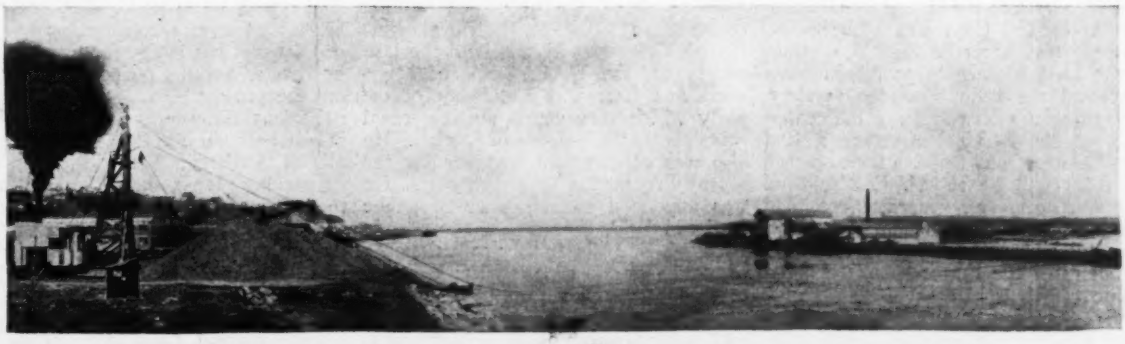
Every effort is being made to hasten the starting of this construction, which will aid in the relief of the unemployment situation.

Bethlehem Steel Corp. Acquires Control of McClintic-Marshall

ANNOUNCEMENT of an agreement to acquire all of the steel-fabricating properties and business of the McClintic-Marshall Co., of Pittsburgh, is made by E. G. Grace, president of the Bethlehem Steel Corp. The acquisition will be paid for by 240,000 shares of Bethlehem common stock and $8,200,000 4½ per cent serial notes maturing in ten equal series annually beginning Jan. 1, 1932. In addition Bethlehem will assume the liabilities of the McClintic-Marshall Co., including $12,000,000 of bonds.

The McClintic-Marshall Co. was incorporated in Pennsylvania in March, 1900. Its annual capacity is about 700,000 tons, which agrees closely with the capacity of the American Bridge Co., subsidiary of the U. S. Steel Corp. Fabricated tonnage of both these companies in the peak year of 1929 was approximately 600,000 tons each. The present annual fabricating capacity of Bethlehem is about 200,000 tons. The total structural steel-fabricating capacity of the country is about 4,500,000 tons annually. Probably enough of this represents obsolete equipment that the fabricating subsidiaries of the two largest steel producers will now control between them over one-third of the fabricating capacity in the United States.

In announcing the merger Mr. Grace said: "The newly acquired plants will be operated by a subsidiary company of Bethlehem having the name 'McClintic-Marshall Corp.' or some similar name." G. H. Blakeley, long a prominent figure in the structural steel industry, will become president of the new company. Mr. Blakeley, who had been successively chief engineer and sales manager of the old Passaic Rolling Mill Co., went to Bethlehem in 1906 on the invitation of Charles M. Schwab to work in collaboration with the late



Part of Napier harbor, where extensive improvements were being made before the earthquake

Henry Grey in developing the broad flange Bethlehem beams. From 1908 to 1927 Mr. Blakeley was manager of the structural steel department of the Bethlehem Steel Co. and from 1916 to 1923 president of the Bethlehem Steel Bridge Corp. In 1927 Mr. Blakeley was appointed vice-president of the Bethlehem Steel Co., having entire charge of the structural steel operations of the company.

The plants of the McClintic-Marshall Co. which will now be added to those of Bethlehem are located at Rankin, Leetsdale, Carnegie and Pottstown, Pa.; Chicago, Ill.; San Francisco and Los Angeles, Calif.; and Buffalo, N. Y.

G. H. Blakeley

Among the notable structures for which the McClintic-Marshall Co. has furnished the steelwork are the New York Central Building, the Farmers Loan & Trust Building, the Lincoln Building, the new Waldorf-Astoria Hotel and the Hudson River Bridge in New York; the Koppers Building, the Gulf Refining Building and the University of Pittsburgh in Pittsburgh; the Buffalo City Hall; the Ambassador Bridge in Detroit; the Civic Opera House and the Merchandise Mart in Chicago; the Telephone Building in San Antonio, and the Mills Building in San Francisco.

Four Men Arrested in Dynamiting of Garland City Bridge

With the arrest of four unnamed persons in connection with the dynamiting of the Garland City, Ark., toll bridge over the Red River on Sept. 3, officials of the state highway commission have expressed the belief that the mystery concerning the destruction of the center span of the $465,000 structure a few days before it was to have been opened to traffic will be solved. As told in *Engineering News-Record*, Sept. 11, 1930, p. 431, apparently a charge of nitroglycerine was set off in each of the shoes of the center span, dropping it into the river between the piers and totally wrecking it. The bridge was being built for the highway commission by the Kansas City Bridge Co., and had not yet been formally accepted by the commission.

Officials refused to divulge the names of the men arrested, saying that such information might lead to the escape of others whose arrest had been ordered. It is said that one of the men now in custody has signed a confession, which implicates several other persons. Highway department officials also refused to reveal the nature of the evidence against the men, except to say that they have learned the source of the explosive and the identity of the persons who placed and fired it. They said that the plot was engineered by persons who had no physical part in executing it.

The dynamiting of the bridge occurred soon after lengthy litigation concerning construction of the bridge had been compromised out of court. The suit grew out of the refusal of the city council of Garland City to permit contractors to build a fill in a street of that town as a part of an approach to the bridge. A ferry, operated at the site of the bridge for several years, was damaged by the explosion, but was repaired immediately and has continued in operation.

The dynamited span is now being reconstructed by the Kansas City Bridge Co., but no part of the old span is being used in the replacement. It was estimated that the original cost of the destroyed span was about $150,000, but that reconstruction and repairs would bring the cost to more than $200,000. The contractor was directed to proceed with reconstruction following a conference of highway department officials, but no announcement has ever been made as to whether the state will share the loss with the contractor.

Joseph S. Stringham New City Engineer in Detroit

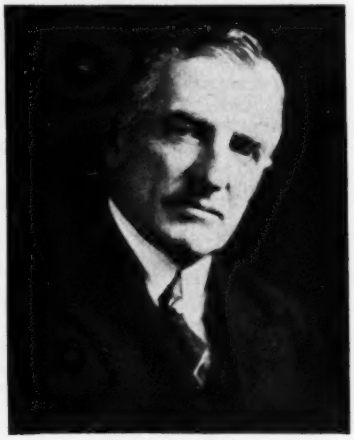
With the advent of the new municipal administration several changes have been made in the engineering department of Detroit, Mich. Joseph S. Stringham, commissioner of public works, has been named city engineer, succeeding Perry A. Fellows. Mr. Fellows has been appointed engineer-manager of the Detroit city airport.

Mr. Stringham, the new city engineer, is a graduate civil and mining engineer of the class of 1895 of the Michigan College of Mines. After working as a surveyor and mining engineer in Colorado, California and British Columbia, he was with the lake survey for the U. S. Corps of Engineers and later was a member of the party which surveyed a possible canal route across the Isthmus of Darien. He also was construction engineer for the Solvay Process Co. for eleven years. He was appointed commissioner of public works in 1930.

Joseph E. Mills, former commissioner of purchases and supplies, has been appointed commissioner of public works, and it is stated that an immediate general reorganization of the department is planned.

W. R. Smith Elected President of A.R.B.A.

William R. Smith, who was elected president of the American Road Builders Association at the annual convention at St. Louis, Mo. in January, as told in these columns Jan. 22, p. 168, was born in North Haven, Conn., in 1867 and comes from old Colonial stock on both sides of the family. His first essay in business was in association with his father and uncle in the New Haven Window Shade Co., New Haven, and later he became manager of a carpet and drapery company in Meriden. In 1896 he began operation of the John S. Lane



W. R. Smith

& Sons' trap rock quarry on the Hudson at Weehawken, N. J. In 1903 he was instrumental in organizing the Lane Construction Corp., and became general manager. In 1913 he became president of the corporation and holds both positions at the present time. Mr. Smith has been a director of the American Road Builders Association for many years.

Sewage-Disposal Problems in the St. Paul District

The metropolitan drainage commission of St. Paul, Minneapolis and contiguous areas, created by the legislature of 1927 to study the subject of sewage disposal and treatment, has made its report, with recommendations as to methods of disposal and location of site. The report recommends that one plant be built to serve the entire metropolitan district and has suggested legislation to be enacted for the purpose of carrying out the project.

Serious differences of opinion have arisen between St. Paul and Minneapolis as to whether South St. Paul, with its packing plants, should be included in the district. Representatives of the civic bodies of the three cities presented their case to the Northwestern Section of the American Society of Civil Engineers on Jan. 30, at which C. J. Rockwood, chairman of the Minneapolis sewage-disposal committee, stated that Minneapolis had decided to go it alone

and that a bill had been sent to the legislature permitting each city to do its own cleaning up. St. Paul recommends the establishment of a metropolitan government to handle the sewage disposal, wiping out boundary lines so far as sewage disposal is concerned.

The question has been made a problem by the use for power purposes of the high dam between St. Paul and Minneapolis, and since it has been so used the dam has not been unwatered. Practically all the sewage from Minneapolis and a portion of that from St. Paul empties into the pool. The completion of another dam at Hastings just below South St. Paul creates another pool into which the sewage of South St. Paul packing plants and a portion of the St. Paul sewage is emptied.

Brick Paving Engineers Discuss Construction

Pavement Bases, Bedding Courses and Joint Fillers Occupy Chief Place at Meeting of Manufacturers Association

WITH about 175 paving engineers and paving brick manufacturers in attendance, the 25th annual meeting of the National Paving Brick Manufacturers Association at Pittsburgh, Pa., last week disclosed keen interest in the betterment of brick pavement construction. Seventeen of the 23 papers and formal discussions presented at the four technical sessions related to problems of pavement design and construction, and four of the remaining papers described specific brick-paved roads. The generally satisfactory variety and quality of the paving brick now being manufactured was commented on in passing to discussions of pavement base, bedding courses and joint fillers.

Pavement bases received special discussions in a group of papers on modern practice. Lyons Mussina, city engineer of Williamsport, Pa., emphasized the need generally of better subgrade studies. A large cause of failure was careless backfilling in installing services prior to paving. The city, he considered, should perform this work. A 6-in., 1:3:6 concrete base was generally sufficient, but better concrete design, with attention to the water-cement ratio and attention to mixing and placing, was desirable. Base thickness should be varied with subgrade and load conditions, the base should be crowned and should have a longitudinal center joint and expansion joints parallel to street railway tracks.

For country roads a 6-in. 1:2½:5 concrete base is employed by R. M. Rumsey, Niagara County superintendent of highways. A transverse joint with an iron plate cover was installed every 100 ft. R. J. Darnell, assistant city engineer, Huntington, W. Va., employs a 1:2½:5 concrete base with premolded expansion joints or asphalt-filled joints to ½ in. from the top and then covered with asphalt-sand mastic. Discussing crack-reduction in concrete base Prof. F. H. Eno, Ohio State University, spoke of treatment to reduce soil friction. George B. Sowers, city engineer of Cleveland, Ohio, described recent concrete base construction with weakened plane contraction joints every 40 ft., and every sixth joint an expansion joint asphalt-filled to within 2 in. of the top and corked with a T-bar over which was pasted an asphalt painted strip of burlap. Similar burlap strips were pasted over the dummy contraction joints.

In a paper on pavement foundations A. T. Goldbeck, director, bureau of engineering, National Crushed Stone Association, discussed distribution of load to subgrade through concrete, crushed-stone and other pavement bases. Formulas were given for base stresses due to various locations and distributions of loads to demonstrate the necessity of concrete quality and careful slab design in bases for brick pavement. Discussion by J. S. Burch, Jr., research engineer, Wire Reinforcement Institute, turned on crack prevention. Based on special investigation of pavement bases in over 30 cities for the American Road Builders Association Mr. Burch presented a series of conclusions which covered a score or more of factors in concrete base materials, design and construction having influence on crack formation and occurrence. In general the conclusions summed up into a statement that base slab design and construction admitted of no moderation of the requirements for concrete paving slab..

A paper by T. L. Flatt, Sangamon County superintendent of highways, and a discussion by S. A. Knisely, director of research, National Association of Flat Rolled Steel Manufacturers, described the construction of, and cited the arguments for, the brick pavement with sheet metal base built last year near Springfield, Ill. The statement was made by Mr. Flatt that so far this pavement had stood up under traffic quite as well as adjacent brick on concrete base. Under present conditions, he stated, the metal base cost somewhat more than concrete.

A description of street railway paving in Birmingham, Ala., by A. Taurman, superintendent, Birmingham Electric Co., was discussed by R. H. Simpson, city engineer, Columbus, Ohio, and George B. Sowers, city engineer, Cleveland, Ohio. The notably solid construction in Columbus was described by Mr. Simpson as first a wide base slab of concrete on which a track with steel ties was blocked up 2 in. and filled in with concrete to a level 2 in. up on the rail. On this brick pavement was laid. An excellent report on fillers and bedding courses by Prof. J. S. Crandell, University of Illinois, was discussed by P. J. Freeman, city engineer of tests, Allegheny County; H. P. Chapman, chief engineer, Ohio highway department; Luke Savage, city engineer; McKeesport, Pa., and Prevost Hubbard, chemical engineer, Asphalt Institute. In respect to fillers the chief point of discussion was penetration and bleeding. The opinion respecting bedding courses was that sand was due for replacement by oil-sand, cement-sand or some self-cementing material as granulated slag. Virtually everywhere, it was stated, sand bedding is causing trouble by shifting or loss through base cracks, and fillers are spoiling the brick paving surface.

A paper by R. W. Crum, director, Highway Research Board, presented the need and opportunities for fundamental highway research. Three interesting papers described the Ohio River Boulevard, by George Hockensmith, superintendent, Booth & Flinn Co., contractors, Pittsburgh, Pa.; the Camp Bowie Boulevard, by T. A. Van Amburgh, vice-president, Thurber Construction Co., Fort Worth, Tex.; the Brecksville Road, by Fred R. Williams, Cuyahoga County engineer, Cleveland, Ohio. They were discussed by E. C. Blosser, Highway Construction Co., Cleveland, Ohio.

New York City Asks for Bids on Sewage Plant

Plans of the New York City sanitation department's $30,000,000 sewage-disposal plant on Ward's Island took a definite step forward last week, when advertisements were printed covering excavation and foundation work. Bids for this work, which the engineers estimate will cost more than $6,600,000, will be opened on March 9 and operations are expected to be under way by June 1. The contract calls for construction of tanks and operating galleries, preliminary and final settling tanks, aeration tanks, substructures for operating galleries, preliminary and return sludge pumping stations, and foundations for the sludge storage and decantation tanks, as well as for laying pipes, conduits and other appurtenances.

When the sewage-disposal plant is finished, about four years from now, it will dispose of about one-sixth of the city's sewage. Intercepting sewers will take the sewage from the upper part of Manhattan through a 3,300-ft. tunnel 8 ft. 6 in. in diameter under the East River. Sewage from a part of the Bronx will be taken under the river through a 5,400-ft. tunnel 10½ ft. in diameter. The sludge residue from the Ward's Island plant will be taken to sea and dumped, and the liquid residue, after being purified, will be turned into the East River.

In addition to the contract for excavation and foundation work, the sanitation department has prepared another contract covering the construction of a dock and sea wall, which the engineers estimate will cost about $675,000. This contract will be advertised soon so that both jobs may proceed simultaneously.

Leonard C. L. Smith, engineering member of the sanitation commission, said the plant will take care of 180,000,000 gal. daily from about 7,500 acres in Manhattan and the Bronx.

Farmer Not Liable for Dynamiting Hat Creek Dam

Three decisions have been rendered by Judge Herzinger of the superior court of Shasta County, Calif., in the litigation arising from the dynamiting of the Pacific Gas & Electric Co.'s Hat Creek dam by Louis P. Joerger, a farmer who claimed that the power company was illegally diverting water from his land riparian to Hat Creek. On Nov. 10, 1930, the company's wooden dam on Hat Creek was dynamited, and Joerger frankly admitted that he did the dynamiting. Following that, the Pacific company secured a restraining order and injunction forbidding Joerger from further molesting the dam, and Joerger applied for an injunction to restrain the Pacific company from interfering with the water in Hat Creek. The power company also brought suit against Joerger for $9,367 to cover the damage to the dam. The decisions just rendered dissolve the injunction against Joerger, grant Joerger an injunction which restrains the power company temporarily from interfering in any way with the Hat Creek waters, and reject the company's claims for damages on the ground that it has no cause for acting against Joerger for dynamiting the dam. The power company will appeal.

Common Brick Manufacturers Meet in Philadelphia

Approximately 300 brick manufacturers gathered in Philadelphia last week to attend the annual convention of the Common Brick Manufacturers Association. The first session, on Feb. 3, was opened by the address of President William Schlake of Chicago, who suggested a plan of financing building. The keynote address by William G. Price, Jr., of Philadelphia, pointed out many ways in which an industry, even in such difficult times as the present, might still make very satisfactory progress. Ralph P. Stoddard, secretary-manager of the association, spoke on the building prospects for the coming year. Jordan A. Pugh, of Washington, had as his subject the development of contacts with departments and bureaus of the federal government.

The session on Feb. 4 was in the form of a "town meeting" devoted to the general subject of marketing. The consensus of opinion might be briefly summarized by saying that the industry should not only employ better sales methods but more particularly develop the servicing of its product, and that the use of brick should be made easier for the designer and consumer.

At the session on Feb. 5 L. B. Lent, chief engineer, pointed out that the market markets for brick were not all confined to the building industry, but that such items as sewer construction, caisson work and precast brickwork for inclosing public utility mains presented a considerable market. Many of what some term "lost markets" could more properly be called "neglected markets."

Judson F. Vogdes, Philadelphia engineer of the association, delivered an interesting talk on the history of reinforced brickwork. Another paper of interest in connection with reinforced brickwork was that delivered by Hugo Filippi, engineer in the Chicago district of the association. Mr. Filippi used a number of lantern slides in his description of a series of tests carried out in accordance with the general test program for reinforced-brickwork as developed by the chief engineer, Mr. Lent. Several points in connection with these tests should be of particular interest: first, that the ultimate carrying capacity was determined through failure of the mortar joint and not in any case through crushing of the brick; second, that in most cases upon removal of the preliminary test loads the specimens showed practically complete recovery from deflection; third, that this type of masonry demonstrated its ability to carry loads far in excess of those which had been expected. One example is typical, a slab designed for a live load of 62½ lb. per sq.ft. actually carried 397 lb. as the ultimate load.

Typical factory bay, ¼ scale
Columns, beams, girders and floor slab are all of reinforced-brickwork.

African Railway Extension Plan Requires Large Bridge

Contracts were recently signed in London for the construction of 25 miles of railway and a large bridge in Africa at a total cost of $7,171,685. The new line will provide direct communication through Portuguese East Africa between Nyasaland and the port of Beira, connecting the systems of the Trans-Zambesian Railway and the Central Africa Railway, and giving the British protectorate of Nyasaland an all-rail outlet to the coast. In addition, the government of Nyasaland is to improve highways within the protectorate and extend steamship facilities on Lake Nyasa. The total cost of all projects, including the railway and bridge, is set at $16,250,000.

The bridge itself, extending across the River Zambesi, will consist of 33 spans of 262 ft. 6 in. and six shore spans, on the north, of 66 ft. 6 in.—a total length of 9,061 ft. 6 in. In addition there will be an approach viaduct on the south with a length of 2,406 ft., made up of spans 31 ft. 10 in. and 39 ft. 8 in. long, with a connecting span of 19 ft. 10 in. joining the viaduct to the main bridge

Welding Society Formed in St. Louis

On Jan. 23, at a meeeting held in the Forest Park Hotel, St. Louis, the St. Louis Welding Society was formed, This society, which consists of 65 charter members representing 26 companies in St. Louis, East St. Louis, and Madison, Ill., is the outgrowth of monthly meetings on welding conducted by the Hill Equipment Engineering Co., of St. Louis. The following were elected officers: president, E. P. Barnes, Moloney Electric Co.; vice-president, W. D. Patterson, American School of Welding; secretary-treasurer, Basil N. Osmin, Hill Equipment Engineering Co.

Future plans of the society, though not definitely announced, include observation and educational tours through St. Louis factories that utilize welding processes in the fabrication of their products, also lectures by men prominent in the welding industry.

Plan Projected to Rationalize England's Shipyards

The National Shipbuilders Security Co., of England, has issued $5,000,000 debenture stock to enable it to carry out an extensive plan for the rationalization of England's shipyards. The constituent members of the company represent virtually the entire shipbuilding industry of Great Britain and Ireland. Its objects are the purchase and dismantling of redundant and obsolete shipyards, the disposal of their contents, and the resale of the sites under restriction against further use for shipbuilding. The company, which has the backing of the Bankers Industrial Development Co., a concern formed under the auspices of the Bank of England to finance the rehabilitation of British industry, has already arranged to take over several yards.

Pennsylvania R.R. Announces Promotions in Personnel

J. C. White, division engineer of the New York division of the Pennsylvania Railroad's maintenance-of-way department, has been promoted to the superintendency of the Monongahela division, with headquarters at Uniontown. J. F. Swenson, division engineer of the Middle division at Altoona, takes Mr. White's place as division engineer of the New York division, with headquarters at Jersey City. He in turn is succeeded by H. W. Anderson, who has been division engineer of the Atlantic division at Camden, N. J. Spencer Danby moves from division engineer of the Cumberland Valley division at Chambersburg to Camden and his position on the Cumberland Valley division is filled by the promotion of N. R. Hunter, who for the past three years has been track supervisor on the Philadelphia terminal division.

Athens Water-Supply Tunnel Holed Through

The Boyati tunnel, near Athens, Greece, said to be the longest hydraulic tunnel in Europe, was holed through on Feb. 9, according to a cable received by Ulen & Co., of New York, who had the contract. This tunnel is one of the links of the $11,000,000 water-supply system for Athens and is 8½ miles long through the Parnes Mountains. The engineers are utilizing a section of the aqueduct built by the Roman Emperor Hadrian in 130 A.D. Ulen & Co. have a joint contract with the Bank of Athens to manage the water supply for 25 years.

Burrard Inlet Bridge Declared a Menace to Navigation

A judgment handed down by the Privy Council in England condemns the Second Narrows bridge in Vancouver harbor, owned by the Burrard Inlet Tunnel & Bridge Co., as a menace to navigation. The Privy Council declares that the bridge amounts to a public nuisance and allows the appeal of the owners of the steamship "Eurana" against decisions of the Exchequer Court of Canada and the Canadian Admiralty Court and intimates that the owners are entitled to recover from the bridge company for damages sustained in a collision between the steamer and the bridge on March 10, 1927. The special act incorporating the bridge company conferred the power to build and maintain the bridge, but limited this power by the express condition that the bridge was not to interfere with navigation.

This bridge has been the scene of a series of more than twenty accidents since it was erected. The latest one occurred last September, when a log carrier crashed into it and carried away the 300-ft. center span. The span, which was raised recently, was found to be undamaged, and preparations were being made to place it again in position. This work has now been held up. The Second Narrows bridge is an important link connecting the city of Vancouver with the industrial city of North Vancouver.

Good Progress on Construction by Washington Power Co.

Good progress is being made on the construction program of the Washington Water Power Co., of Spokane. The major feature, rebuilding the water system serving Clarkston, Wash., is practically completed. This project involved laying 7,500 ft. of 48-in. wood-stave pipe and rebuilding and repairing bridges and trestles carrying the pipe line. The intake dam, on Asotin Creek, was raised 2 ft. and new frames were installed for the headgate screens. Water was turned into the pipe line on Dec. 27.

The new 110-kv. line to Lewiston, Idaho, from Moscow, Idaho, is near completion. The foundation for the Leon Junction substation, a point on this line, has been completed. Work is proceeding on the three new substations at Harrington, Sprague and Ritzville.

S. G. Porter Elected President of Engineering Institute of Canada

S. G. Porter, manager of the department of natural resources, Canadian Pacific Ry., Calgary, Alta., was elected president of the Engineering Institute of Canada at its annual meeting in Montreal Feb. 4.

Mr. Porter is a native of Texas and a graduate of Baylor University, Waco, Tex., and of Massachusetts Institute of Technology, where he received his civil engineering degree in 1903. The same year he began work as an assistant engineer in the U. S. Bureau of Reclamation, later becoming chief engineer of the Arkansas Valley Sugar Beet & Irrigated Land Co. at Holly, Colo.

In 1913 Mr. Porter went to Canada to enter the dominion irrigation office at Calgary. He was later promoted to be assistant chief engineer and acting commissioner of irrigation. In 1918 he left government service to become superintendent of operation and maintenance of the southern section of the Canadian Pacific Ry. irrigation systems. He remained in this position until 1925, when he was appointed assistant manager of the company's department of natural resources and in 1927 he was appointed manager.

The Business Outlook

During the last half of January the slight improvement evident after the turn of the year petered out. The January level averaged about the same as November, but a little above December. January's upturn in pig-iron output — first since last April — may be another sign that the low point was passed in December. But the recent slackening of the rate of improvement in steel, coal and power production, building, car loadings and check payments suggests how irregular, feeble and protracted recovery is likely to be without the support and stimulation of external factors brought to bear by intelligent, courageous and cooperative banking policies.

—The Business Week, Feb. 11.

WASHINGTON NOTES

By PAUL WOOTON
Washington Correspondent

New Canadian Treaty Suggested To Preserve Beauty of Niagara Falls—Road Work Is Speeded

AS THE result of the recent collapse of a small section of the escarpment on the American side of Niagara Falls, the Senate foreign relations committee has decided to take steps toward negotiating a new treaty with Canada solely for the preservation of the beauty of the falls. A treaty already agreed to by Canada which authorizes the diversion of additional water from the Niagara River for power purposes has been pending in the committee for two years.

Senator Borah, chairman of the committee, has been requested to confer with Secretary of State Stimson on the question of negotiating a new treaty. The present treaty permits the diversion of an additional 20,000 sec.-ft. of water, one half to be utilized by Canada and the other half by the United States. In return for the additional diversion, the power companies agreed to bear the entire cost of building in the river the submerged weirs necessary to regulate the flow.

Two factors have tended to retard action in the committee on the present treaty. One has been the unwillingness of some of the lake state senators to lose the opportunity of obtaining a trading point with Canada in working out a comprehensive treaty concerning the diversion of boundary waters. These senators believe that the Niagara remedial treaty should not be considered separately but should be made a part of a general treaty. The other factor is the attitude of some of the anti-power senators who contend that, even though the power companies would be granted a right to the additional water for only seven years, the use of the water during that period would give the companies a moral claim to the continuance of the diversion.

Speeding Up Construction

A large part of the work provided for in allocations made under the emergency appropriation bill is now under way, the secretary of war announced last week. A total of $17,818,340 was made available for speeding up civil engineering activities of the war department in the emergency construction appropriation bill that was passed on Dec. 22. The purpose of this appropriation was to stimulate federal construction work to relieve unemployment. Bids covering a total of $14,147,340 of the allotted funds were opened during January, Secretary Hurley stated. Awards have been made by division engineers in all cases in which it appeared that the low bidder was responsible and was in a position to undertake the work immediately. Additional work involving expenditure of $593,000 has been begun by labor hired by the Corps

of Engineers. Bids covering approximately $1,968,000 will be opened in February.

Premier Bennett's Visit

Prime Minister Bennett's visit to Washington is expected to give greater impetus to final negotiation of plans for the St. Lawrence waterway. Although President Hoover said that no formal matters were under discussion, he hoped that his informal conversations with the Canadian premier on problems of the future would lead to a better understanding of them.

Emergency Road Work Progressing

By the end of February at least $35,000,000 of the $80,000,000 appropriated for emergency road work will have been taken up by the states. At the end of January $15,000,000 of the total had been taken up. Apparently a somewhat greater amount will be taken up in February. From what is known of the plans of the state highway commissions it is apparent that work will have been begun by April 1 on the projects which will absorb the entire emergency appropriation.

Brief News

INTEREST OF CONTRACTORS in the Hoover Dam project is shown by the fact that 196 copies of the specifications have been applied for.

FORMATION of the Arundel-Atkinson Construction Corporation for the purpose of bidding on the work for the construction of Hoover Dam is announced. It is stated that the new corporation will represent the combined forces of the Arundel Corporation, of Baltimore, and Lynn H. Atkinson, of Los Angeles.

A COMMITTEE OF LEADERS in business, public affairs and humanitarianism has been appointed by the New York State Economic Council to study unemployment, invalidity and old age, and to work out and present for consideration a program for combating in the most practical and effective manner the hardships caused by them.

A BILL has been introduced in the New York legislature amending the general municipal law by providing that a contractor may be required to file both a performance bond and a separate bond to protect the subcontractors, material men and laborers. The exaction of such bond is now required on state contracts.

A GARBAGE CONTRACT has been signed in Albuquerque, N. M., with the Municipal Salvage Corporation. The contract will run for 25 years and calls for a minimum fee of 40c. a month for collection in the residential districts and $1 a month in the business districts. Collections will be made four times a week in the residential sections and daily in the business areas.

Personal Notes

GEORGE R. MACLEOD, assistant chief engineer of Montreal, has been made city railways engineer and will be intrusted with all questions relating to railways and tramways in the city. In his new position he will supervise the construction of all bridges, tunnels and viaducts.

CHARLES J. CARROLL, who has spent many years in construction work in Europe and Asia, has been appointed director general of the Persian state railways by the shah of Persia, as one of the first steps in carrying out a plan of government railroads.

E. O. KORSMO, who has been with the Gauger-Korsmo Construction Co., Memphis, Tenn., and has been connected with many construction projects in Memphis in recent years, announces the severance of his connection with that company and the formation of the E. O. Korsmo Construction Co., with headquarters in Memphis.

ARMY ADAMS, civil and hydraulic mining engineer, who for several years has been superintendent of the Porcupine Mining Co., of Haines, Alaska, has been promoted to be general superintendent and assistant general manager, with winter offices in Seattle.

L. G. SMITH, of Montgomery, formerly bridge engineer of the Alabama state highway department and a member of the highway commission in 1926, has been made director of the new commission appointed by Governor Miller. H. D. BURNUM and WILLIAM HERZBERG, who have been division engineers in the department, are made associate members of the commission.

T. N. JONES, of the Alabama Polytechnic Institute at Auburn, Ala., has been added to the force of the Mississippi A. and M. College experiment station at Starkville as agricultural engineer, succeeding John W. Carpenter, Jr., who has resigned to head the extension agricultural engineering division of Oklahoma.

SOCIETY CALENDAR

AMERICAN CONCRETE INSTITUTE, Detroit; annual convention, Milwaukee, Feb. 24-26.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, annual convention, Chicago, March 9-12.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; regional meeting, Pittsburgh, March 18.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; spring meeting, Norfolk, Va., April 15.

AMERICAN WATER WORKS, ASSOCIATION, New York; annual convention, Pittsburgh, Pa., May 25-29.

AMERICAN WOOD-PRESERVERS' ASSOCIATION, at its annual meeting in Philadelphia recently, voted to hold its 1932 meeting in St. Louis, Mo., beginning Jan. 26.

FIFTH DIVISION ENGINEERS CLUB, composed of engineering employees of the Tennessee state highway department in 30 counties of southwest Georgia, has elected the following officers: president, J. E. Bain, Bainbridge; vice-president, J. C. Collins, Lumpkin; secretary-treasurer, A. Antignac, Cairo.

MARYLAND ASSOCIATION OF ENGINEERS held its annual meeting in Baltimore Jan. 29 and 30. Resolutions were unanimously adopted urging the enactment of a state registration law for engineers. Nineteen technical papers were presented and discussed, those of particular interest being on "Curing of Concrete," by Paul B. Wolf, of Baltimore; on "Crack and Joint Surveys in Concrete," by W. W. McVicker, and on "High-Early-Strength Concrete," by S. S. Steinberg, professor of civil engineering, University of Maryland. Henry G. Perring, of Baltimore, was reelected president, and F. T. Norcross, Washington, D. C., and Ralph Rizer, Cumberland, Md., were elected vice-presidents.

Obituary

JOHN LUNDIE, consulting engineer, inventor of several mechanical devices bearing his name and president of the Lundie Engineering Corp., died on Feb. 9 at his home in New York City. He was 73 years old. Dr. Lundie was born in Scotland and after doing harbor construction work there came to the United States and engaged in engineering work in construction of bridges and railroads in the '80s, principally in Oregon and Washington. He also assisted in the electrification of the Manhattan elevated, the Boston elevated and the London underground rapid-transit lines. Dr. Lundie was a member of the American Society of Civil Engineers, the American Institute of Consulting Engineers and the American Association for the Advancement of Science.

L. B. HITCHCOCK, a prominent engineer of Arizona, died of spinal meningitis en route to his home in Phoenix from California, Jan. 27. Mr. Hitchcock was secretary-treasurer and general manager of the contracting firm of Schmidt-Hitchcock. He was 48 years old. A native of Jackson, Mich., Mr. Hitchcock went to Arizona in 1907 as division engineer for the Arizona Eastern Railroad, and was city engineer of Phoenix from 1918 to 1926 and city manager in 1926. He had been active for several years in the Verde River Irrigation and Power District. Among the outstanding construction projects directed by Mr. Hitchcock were the paved highway crossing the southern California sand dunes west of Yuma, Ariz., and the excavation for the leaching plant of the Inspiration Consolidated Copper Co. at Inspiration, Ariz.

RANDOLPH GOODE WARD, engineer and railroad builder, died on Feb. 1 at his home in Bladensfield, Va. Mr. Ward assisted in the construction of the Panama Canal railway and also railway lines in Argentina.

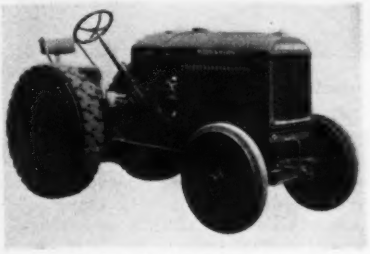
J. S. LEWIS, secretary of the Nashville (Tenn.) park commission since 1911, died in Nashville on Feb. 4.

LESLIE GRAHAM BERRY, president of the recently organized Southern Engineering Co., of Charlotte, N. C., died on Jan. 3.

Construction Equipment and Materials

New Tractor Model of Increased Capacity

Announcement of a larger McCormick-Deering industrial tractor, to be known as model 30, has been made by the International Harvester Co., Chicago, Ill. The new machine, in general, follows the pattern of the well known model 20. It is equipped with a four-cylinder valve-in-head engine developing 40 belt horsepower at a governed speed of 1,050 r.p.m., has a wheel base of 86 in. and a total over-all length of 129 in. Other features include removable cylinders and a ball-bearing crankshaft. Ignition is supplied by a high-tension magneto; lubrication is of the circulating splash type with built-in oil filter. The carburetor system is equipped to operate on either kerosene or gasoline.



Larger industrial tractor

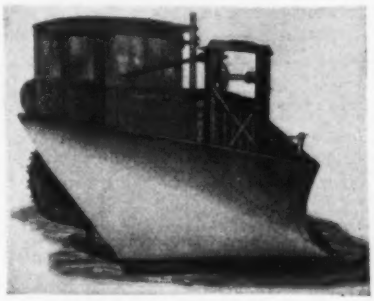
Small Revolving Shovel

Production has been started by the Speeder Machinery Corp., Cedar Rapids, Iowa, on a new fully convertible full revolving ⅜-cu.yd. gasoline shovel which incorporates all the features of the ½-cu.yd. model of this company and, in addition, a number of other improvements. The machine is equipped with a 14-ft. boom and 10-ft. dipper stick as standard equipment, and employs a 41-hp. four-cylinder motor. For crane or dragline operation booms varying from 22 to 26 ft. can be attached. It is also possible to use either a pull shovel or skimmer scoop. Other features of the machine include electric lights and starter as standard equipment, optional two- or four-speed transmission, fully inclosed cab, cable crowd, and extremely short tail swing.

⅜-cu.yd. full revolving shovel

Tractor Snow-Plow Attachment

To fill in the gap in snow-removal equipment between light truck-mounted plows and the heavier units used with large tractors the LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa, has designed a hand operated V-plow for mounting on Caterpillar tractors, models 20 and 30. The blade of this unit is controlled from inside the tractor cab by a hand wheel, shaft and worm gear, allowing the operator to raise or lower the unit without stopping or slowing down. The push point is located at the center of the track on the tractor, thus giving it the full benefit of the center pivot mounting. This model can also be equipped with side wings, each of which is controlled by a high-speed chain hoist.



V-plow on Caterpillar 30 tractor

New Welding Process

A new method of oxyacetylene welding known as the Lindeweld process has been introduced by the Linde Air Products Co., 30 East 42d St., New York City. This process is particularly adaptable to overland pipe line construction, although future developments are expected to lead to its application in many other industrial welding operations. Savings of from 30 to 60 per cent of the time required to make a weld, decreased oxygen and acetylene consumption and consistently higher strengths are advantages claimed for the Lindeweld process, which is the result of years of laboratory research and field testing. It depends essentially on a new method of blowpipe manipulation and upon the use of a new welding rod introduced for that purpose, known as Oxweld No. 24 Lindeweld process welding rod. It is claimed that experienced welders find no difficulty in adapting themselves to the new method.

Large Elevating Grader

Designed for use with Caterpillar 60 tractor, a heavy elevating grader driven by a frame-mounted gasoline motor has been designed by the Caterpillar Tractor Co., Peoria, Ill., for heavy-duty earth-moving service. The machine, which weighs 15,375 lb., has an over-all length of 15 ft. and is equipped with either 16- or 19-ft. carriers. Belts are 42 in. wide. Power from the motor passes through a reducing gear set to the main shaft, which is equipped with a self-aligning coupling and self-aligning ball bearing. A 28-in. rigid disk plow is standard equipment, but rotary disks or moldboard plows are available.

Motor-driven elevating grader

Loader Equipped With Weighing Device for Batching

A new dial-scale weigh hopper which, it is claimed, will weigh within 0.4 per cent of absolute accuracy, even while the bucket loader on which it is mounted is operating at an angle of 4 deg., has been released by the Barber-Greene Co., Aurora, Ill. It is used with the newly

Weighing attachment on loader

announced model 62 bucket loader, a crawler-mounted, self-feeding, one-man-operated machine with a capacity of 62 cu.ft. per minute.

The weighing unit built into the hopper is an American Kron scale with a dial graduated to 2-lb. units. It is provided with two markers which can be set to indicate the desired reading. Directly above the weigh hopper is a small auxiliary hopper holding approximately 360 lb. of material. At the top of the weigh hopper itself is a sliding horizontal gate controlled from the operator's platform by a chain. When the indicator hand on the scale dial is near the desired weight reading, the sliding horizontal gate is closed, allowing the auxiliary hopper to fill up. By working the sliding gate with the chain, the material is allowed to feed from the auxiliary hopper into the weigh hopper until the required weight is obtained. The weigh hopper will weigh batches up to 3,600 lb. not to exceed 32 cu.ft. in volume.

Self-Propelling Earth Mover

An improved type of earth-moving machine, to be known as the Marion Mule, has been announced by Marion Mules, Inc., Marion, Ohio, a new company formed as the result of the acquisition of the R. J. W. Mfg. Co., Bucyrus, by the Marion Steel Body Co. The Marion mule consists of a 4-5 cu.yd. body mounted on a chassis driven by a McCormick-Deering model 10-20 industrial tractor unit through a four-speed transmission and crawler tracks. The tractor drive axle does not carry the load, which is transmitted to an auxiliary or dead axle. The drive axle connects with the dead axle through a gear reduction of 5 to 3. Front steering wheels are mounted on a special full floating and oscillating axle of Marion design which maintains the vertical position of the wheels regardless of ground irregularity. The body is dumped by gravity and when in lowered position can be used to bulldoze the load. Besides the crawler equipment, the Marion mule can also be obtained with steel wheels or pneumatic tires.

Front view of earth-carrying machine

Wheel-mounted snow loader

Snow Loader Mounted on Tractor

Designed so that it can be moved from point to point more quickly than a crawler-mounted machine, the model 31 snow loader developed by the George Haiss Mfg. Co. Inc., 141st St. and Park Ave., New York City, consists of a snow boom mounted on a Case tractor equipped with heavy rubber-tired wheels. The machine has a maximum traction speed of 8¾ m.p.h. and a slow crowding pace of 35 ft. per minute. Elevator speed is 160 ft. per minute, this part of the mechanism being driven through a Haiss take-off box inserted between the rear end of the tractor and the engine. Crowding is accomplished by a worm which can be engaged or disengaged at will. When in operation, the differential action of the rear axle is cut out by means of a jaw clutch locking device so that there will be no slippage of the wheels. Controls are centered at the operator's platform. This machine has an over-all length of 23 ft. 7 in., a height of 12 ft. 5 in., when in operation and 9 ft. when collapsed, a clearance for trucks of 9 ft., and a weight of 15,500 lb. complete.

Business Notes

CHAIN BELT CO., Milwaukee, Wis., announces the election of a new president, Clifford F. Messinger, succeeding his brother, C. R. Messinger, who resigned to become president of the Oliver Farm Equipment Co. and who has been elected chairman of the board of the Chain Belt Co. G. K. Viall, works manager since 1929, has been elected a vice-president.

CANADIAN TUBE & STEEL PRODUCTS, LTD., Montreal, Canada, has appointed Milton Lewis Hersey president, to succeed the late James L. Waldie. Charles M. Thomson has been appointed vice-president in charge of manufacturing.

HARNISCHFEGER CORP., Milwaukee, Wis., has elected Walter Harnischfeger president and treasurer. He succeeds his father, the late Henry Harnischfeger.

NATIONAL FIREPROOFING CORP., Pittsburgh, Pa., has purchased the plant of the Vulcan Tile & Brick Co. at Birmingham, Ala.

FAIRBANKS, MORSE & CO., Chicago, Ill., announces the appointment of C. B. Murphy as manager of stationary diesel engine sales, with headquarters at Chicago.

REPUBLIC FIREPROOFING CO., INC., New York City, has elected Alden J. Palmer president and general manager. Mr. Palmer was formerly connected with the George A. Fuller Co.

MCLENNAN, MCFEELY & PRIOR, LTD., Vancouver and Victoria, B. C., has acquired the entire stock and good will of the iron and steel firm of Balfour, Guthrie (Canada), Ltd., of Vancouver.

RAYMOND CONCRETE PILE CO., New York City, has opened a Northwest office in Seattle, Wash., in charge of George H. Tulley, district manager.

PACIFIC COAST CEMENT CO. has promoted Darwin Meisnest, of Seattle, to the position of vice-president in charge of sales. He was formerly sales manager.

GOULDS PUMPS, INC., Seneca Falls, N. Y., announces that H. W. Foulds, assistant to the president, has been placed in general charge of all sales.

DOMINION, HOIST & SHOVEL CO., LTD., Lachine,, Quebec, has been organized jointly by the Dominion Bridge Co., Ltd., the Dominion Engineering Works, Ltd., and the American Hoist and Derrick Co. for the manufacture, in Canada, of the "Dominion" line of excavating shovels, locomotive and crawler cranes, revolving cranes, hoisting machinery and derricks. The new company will use the designs of the American Hoist & Derrick Co., which has been a large exporter to the Canadian market.

KENTUCKY ROCK ASPHALT CO., Louisville, Ky., has appointed M. A. Lippman, former instructor in civil engineering at the Polytechnic Institute of Brooklyn, its representative in New York, New Jersey and New England. Mr. Lippman has established offices at 11 West 42d St., New York City.

UNIVERSAL POWER SHOVEL CO., Milwaukee, Wis., has appointed the B. Hayman Co., Los Angeles, Calif., Southwest distributor for shovels and material-handling equipment.

MASONITE CORP., Chicago, Ill., announces the following appointments: John P. Gillies, general manager; R. G. Wallace, director of sales and advertising, and Frank L. Campbell, sales manager.

ASSOCIATED EQUIPMENT DISTRIBUTORS has selected as president for 1931 Oscar B. Bjorge, manager of the Clyde Equipment Co., Portland, Ore.

CANADA CEMENT CO., LTD., has completed plans for the construction of a new manufacturing unit adjoining its present plant near Colborne, Ont. This will cost $500,000, and will be equipped for the wet process of manufacture.

EQUIPMENT CORPORATION OF AMERICA, Chicago, Ill., has advanced Joseph V. Sullivan, Western sales manager, to the position of general sales manager.

CHICAGO PAVING LABORATORY, Chicago, Ill., has acquired the new name of Chicago Testing Laboratory, Inc., in order more adequately to express the broader aspects of its activities. The organization will not abandon the old name, but will use the dual title.

GLEDHILL ROAD MACHINERY CO., Galion, Ohio, has been formed to produce a line of drawn graders and, later, other road-building and maintenance equipment. Plans are now being drawn for the first manufacturing building. At the head of the new firm is E. C. Gledhill, until recently in charge of the road-machinery department of the Rome Mfg. Co., and previously connected with the Galion Iron Works & Mfg. Co., and the Bucyrus Road Machinery Co.

Business Side of Construction

Current Construction Conditions

Major economic events in the construction industry in 1931 were outlined in last week's issue. It was shown that although the year's volume was 15 per cent below that of 1930 there had been a turn for the better in January. Rising volume has continued in the the first week of February: industrial buildings up 270 per cent over a year ago; other buildings, 162 per cent; engineering works except buildings, 122 per cent. *Contracts let in 1931, cumulative value, are 10 per cent ahead of 1930 contracts.*

The larger contract total has not yet registered with the materials producers. Freight loadings thus far have been generally lighter: lumber, 14 per cent; iron and steel, 13; brick and clay products, 9; lime and plaster, 8; cement, 7; concrete aggregates, 5; explosives, 3; prepared roofings, 3.

Brick Prices—The wholesale price of brick at New York rose $1 last month, to $11, but is now back to $10; dealers' price, $13 delivered. In Chicago the price is stabilized at $12 because of nearness to source of supply and tranquil labor conditions at the yards. Generally, another winter of hard sledding has been passed, with still fewer manufacturers left. As an instance, one of the oldest concerns in New Jersey has closed its Sayreville and South River Plants. Delivered prices are up 50c. at Kansas City and 75c. in Atlanta; down $2 and $2.75 respectively at Minneapolis and Denver.

Cement Prices—During January price reductions of 1c. to 17c. were made at mills in Alabama, Kansas, Iowa, Illinois, Indiana, Ohio and Virginia. New York dealers expect a 5c. rise with the commencement of spring deliveries. The Louisiana highway commission received tenders Jan. 19 on a record letting, 20,000,000 bbl.; the high was $2.49 on 94,000 bbl., the low $2.32 on 47,000 bbl., a range of 17c. Reduction in the trade discount continues to be a live subject with dealer organizations, with the national body opposed to the cut. Seasonal acceleration is reported in the Birmingham district, where plants will soon increase working forces 50 per cent.

Steel Demand—The $1.60 price for structural steel held only for the first week of the year, and is now $1.65, though ordering is light. The call for reinforcing bars for highway work is mounting briskly and the price is up 5c. at Pittsburgh for stock lengths.

Labor—In a number of cities special projects and measures have furnished work for some of the previously unemployed. Dredging operations near Philadelphia will soon employ 1,000 men. Shipyards at Kearny employed 3,000 men in January on a single order. New steel contracts at Mobile have placed the mills on regular schedule. Buffalo employs only two-year residents on city work. Chicago unions are placing men on part time, and on some projects both contractors and laborers receive part of their pay in stock of the projects.

Financing—New securities for corporation and public-works construction issued in January totaled 513 millions, compared with 292 in November and December, 515 millions average for the year 1930, and 727 millions in January, 1930.

COSTS AND CONTRACTS

E. N.-R. Index Numbers

Cost		Volume	
Feb. 1, 1931	**196.61**	**January, 1931**	**208**
Jan. 1, 1931	194.48	December, 1930	192
Feb. 1, 1930	206.46	January, 1930	199
Average, 1930	202.85	Average, 1930	260
Average, 1929	207.02	Average, 1929	317
1913	100.00	1913	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Feb. 12, with some comparisons, total as follows:

(In Thousands of Dollars)

	Feb. 12, 1931	Average of Last Four Weeks 1931	1930
Buildings:			
Industrial	$3,583	$3,262	$5,165
Other	11,822	16,314	15,255
Streets and roads.	13,094	11,119	6,319
Other eng. constr..	7,322	11,975	13,845
Total	$35,821	$42,671	$40,586
Total, all classes Jan. 1 to Feb. 12:			
1931			$330,882
1930			301,843

Men Replace Machines on Los Angeles Project

Men have replaced machines on a San Fernando Valley project of the Los Angeles board of water and power commissioners. On the recommendation of H. A. Van Norman, chief engineer of the department, the commissioners authorized the employment of men to dig a trench for a 54-in. water main across a corner of the valley rather than use a mechanical ditch digger for the job. About 225 men were put to work with picks and shovels. The action of the commissioners was in an effort to aid relief for the unemployment situation.

The trench under construction is 9½ ft. deep and 5 ft. 3 in. wide. It will carry a 54-in. feeder from the lower San Fernando reservoir to the Chatsworth reservoir, both a part of the municipal water system. Funds for the work were provided in a $38,000,000 water bond issue voted last May.

The 54-in. main will replace a 45-in. main laid in 1916. The latter is being cleaned and reconditioned for further use.

$30,000,000 Power Development in Quebec

The MacLaren Quebec Power Co. will proceed immediately with the installation of a 130,000-hp. development near Buckingham, Quebec, at Masson Falls, on the Lievre River 17 miles from Ottawa, where there is a head of about 180 ft. of water. This construction and an addition to the near-by High Falls development on the same river will require an outlay of approximately $30,000,000.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN JANUARY, 1931

Thousands of Dollars (000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States Jan., 1931	United States Jan., 1930	Canada, Jan., 1931
Water-works	$196	$906	$63	$294	$875	$3,097	$5,431	$4,827	$1,103
Sewers	180	2,723	542	893	272	469	5,079	8,406	1,571
Bridges, public	.....	1,713	1,507	6,447	1,531	230	11,428	7,798	96
Excavation	25	1,096	86	291	1,227	183	2,908	3,329	1,591
Streets and roads	1,902	4,366	11,504	3,254	14,603	3,991	39,620	32,152	100
Federal government	2,332	469	2,087	610	3,414	1,664	10,576	9,534	26
Unclassified, public	122	13,580	1,410	541	410	71	16,134	14,431	5,800
Buildings, public	1,288	16,851	262	4,845	731	1,382	25,359	22,589	348
Total public	6,045	41,704	17,461	17,175	23,063	11,087	116,535	103,066	10,635
Buildings, industrial	1,736	4,796	90	4,682	1,648	1,183	14,135	38,722	1,005
Buildings, commercial	3,885	36,080	650	8,060	529	5,112	54,316	73,056	800
Bridges, private	.....	.....	.....	.....	230	.....	230	1,000	.....
Unclassified, private	1,472	35,782	.....	3,895	7,230	3,660	51,979	23,092	250
Total private	7,093	76,658	740	16,637	9,637	9,895	120,660	135,870	2,055
January total, 5 weeks	**13,138**	**118,362**	**18,201**	**33,812**	**32,700**	**20,982**	**237,195**	.....	**12,690**
December, 1930, 4 weeks	10,184	17,161	22,663	24,102	32,614	12,091	172,815	.....	12,116
January, 1930, 5 weeks	7,353	96,510	22,932	34,266	32,456	45,419	.....	238,936	14,712

Current Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

Building Materials

PORTLAND CEMENT—Prices per barrel, for cement in cloth, *without including charge for four bags at 10c. each*; cash discount not deducted. Prices are delivered by truck to contractors at site of job. For cement in paper bags add 15c. per bbl.:

	Feb. 5, 1931	One Mo. Ago	One Yr. Ago
Atlanta	$2.38	$2.38	$2.35
Baltimore	2.60	2.60	2.40
Birmingham	2.60	2.60	2.40
Boston	2.35	2.35	2.65
Chicago	.....	.....	.....
Cincinnati	2.26	.....	.....
Cleveland	.....	.....	.....
Dallas	2.15	2.15	2.15
Denver	*2.20*	2.61	2.61
Detroit	.....	.....	.....
Jersey City	2.33	2.33	2.60
Kansas City	2.15	2.07	2.65
Los Angeles	1.92	1.92	2.42
Minneapolis	.....	.....	.....
Montreal	2.20	2.20	2.05
New Orleans	2.35	2.35	2.65
New York	2.20	2.23	2.30
Philadelphia	2.15	2.15	2.10
Pittsburgh	2.15	.....	.....
St. Louis	2.15	2.15	2.10
San Francisco	2.64	2.64	2.54
Seattle	2.25	2.25	2.70

Current mill-prices per barrel, in carloads, without bags, f.o.b.:

Alpena, Mich	$1.55	Limedale, Ind	*$1.69*
Buffington, Ind	1.62	Mason City, Ia	*1.71*
Hannibal, Mo	1.72	Norfolk, Va	*1.86*
Houston, Tex	*1.94*	Northampton, Pa	1.67
Hudson, N. Y	1.77	North Birmingham, Ala	*1.66*
Ironton, Ohio	*1.66*	Steelton, Minn	1.77
Iola, Kan	*1.59*	Universal, Pa	1.62
La Salle, Ill	*1.66*	Wyandotte, Mich	1.50

SAND AND GRAVEL—Per ton, delivered by dealers. Weight of sand per cu.yd., 1½ tons; gravel, 1½ tons, unless otherwise specified in pounds:

	Gravel		Sand
	1½ In.	¾ In.	
Atlanta	$3.25	$3.25	$2.50
Baltmore	2.35	2.55	2.08
Birmingham, per cu.yd., 2,600 lb	3.50	3.50	3.00
Boston	1.75	1.75	1.15
Chicago, per cu.yd	2.00	2.00	2.00
Cincinnati	1.75	1.75	1.50
Cleveland, per cu.yd., 3,000 lb	2.60	2.60	2.50
Dallas, per cu.yd., 2,750 lb	3.00	3.00	2.50
Denver, per cu.yd., 2,700 lb	1.95	1.95	1.35
Detroit	2.50	1.85	1.65
Kansas City	*1.75*	1.75	1.75
Los Angeles	1.50	1.50	**1.50**
Minneapolis, per cu.yd., 2,800 lb	2.40	2.40	1.10
Montreal	1.25	1.25	1.25
New Orleans, per cu.yd., 2,700 lb	2.95	2.95	1.80
New York, per cu.yd	3.40	3.40	2.15
Philadelphia	2.30@3.15	2.30@3.15	1.50@2.31
Pittsburgh	1.55	1.55	1.75
St. Louis	1.40	1.40	1.00@1.20
San Francisco	1.75	1.75	1.75
Seattle, per cu.yd., 3,200 lb	1.75	1.75	**1.75**

Note: New York gravel weighs 2,800@3,000 lb. and sand, 2,700 lb. per cu.yd.

CRUSHED STONE—Per ton, delivered by dealers. Weight per cu.yd., 1½ tons, unless otherwise specified in pounds:

	1½ In.	¾ In.
Atlanta	$3.25	$3.25
Baltimore	2.60	2.80
Birmingham, limestone, per cu.yd	3.00	3.25
Boston	2.00	2.00
Chicago, limestone, per cu.yd., 2,500 lb	2.00	2.00
Cincinnati	2.25	2.25
Cleveland	2.60	2.60
Dallas, per cu.yd., 2,500 lb	3.25	3.25
Denver, granite, per cu.yd., 2,700 lb	2.50	2.50
Detroit, limestone	2.25	2.25
Kansas City	1.90	1.90
Los Angeles	1.40	1.40
Minneapolis, limestone, per cu.yd., 2,600 lb	2.40	2.40
Montreal	1.90	2.10
New York, limestone, per cu.yd	3.40	3.40
Philadelphia, limestone	2.30@3.15	2.30@3.15
Pittsburgh	2.75	2.75
St. Louis	1.40	1.40
San Francisco, trap rock	1.65	1.65
Seattle, per cu.yd., 2,700 lb	3.00	3.00

CRUSHED SLAG—Manufacturers' quotation on crushed slag in carloads, per net ton, at plant:

	1½-In.	¾-In.	Roofing	Sand
Birmingham, Ala	$0.90	$1.15	$2.05	$0.55
Buffalo District	1.25	1.35	2.25	1.25
Cleveland, Ohio	1.10	1.10	....	1.30
Western Pennsylvania	1.25	1.25	2.00	1.25
Toledo, Ohio	1.10	1.10	1.10	1.00
Youngstown District	1.25	1.35	2.00	1.25

CONCRETE BLOCKS—Manufacturers' quotations on standard, 8x8x16-in., hollow, delivered to job, each:

Boston	$0.18@$0.20	Minneapolis	$0.11
Brooklyn and Queens	.12@ .14	New Orleans	.20
Cleveland	.16@ .17	Philadelphia	.18@.25
Denver	.22	Pittsburgh	.20
Detroit	.15	St. Louis	.17
Kansas City	.18		

HOLLOW TILE—Building tile per block, delivered by dealers to contractors in lots of 2,000 pieces or over:

	4x12x12	6x12x12	8x12x12	10x12x12	12x12x1
Atlanta	$0.14	$0.18	$0.24	$0.30	$0.36
Baltimore	.105	.....	.20	.....	.26
Birmingham	.09	.127	.174	.218	.261
Boston	.08	.113	.15	.21	.25
Chicago	**.068**	**.0935**	**.1275**	**.1647**	**.183**
Cincinnati	.06815	.09485	.129	.165	.184
Cleveland	.064	.088	.128	.171	.19
Dallas	.103	.136	.194	.251	.306
Denver	.0975	.135	.175	.2125	.25
Detroit	.098	.135	.184	.24	.265
Kansas City	.0525	.077	.184	.24	.265
Los Angeles	.085	.122	.175	.232	.285
Minneapolis	.0611	.081	.10605	.1302	.1737
New Orleans	.068	.093	.13	.176	.212
New York	.0864	.1296	.162	.....	.....
Perth Amboy, N. J.(f.o.b.)	.....	.....	.....	.2388	.2956
Philadelphia	.105	.14	.215	.28	.34
Pittsburgh	.056	.078	.1175	.14	.1726
St. Louis	.075	.10	.14	.175	.21
San Francisco	.108	.156	.255	.....	.....
Seattle	.085	.115	.18	.....	.....

BRICK—Prices delivered by dealers per thousand, are as follows:

	Common	Paving 3x8½x4-In.	F.O.B. 3½x8½x4-In.
Atlanta	**$17.00**	$42.00	.....
Baltimore	13.00	40.00	$46.00
Birmingham	15.50	31.00	.....
Boston	15.00	43.00	47.00
Chicago	12.00	42.00	45.00
Cincinnati	16.00	35.00	37.00
Cleveland	12.00@14.00	33.00	36.00
Dallas	14.50	.....	.....
Denver	*9.00@10.00*	.....	.....
Detroit	15.50	33.50	36.50
Kansas City	**15.00**	.....	.....
Los Angeles	10.00	.....	.....
Minneapolis	*10.00*	.....	.....
Montreal	20.00	.....	.....
New Orleans	12.00	38.00	45.00
New York	13.00	45.00	50.00
Philadelphia	15.50	40.00	45.00
Pittsburgh	16.00	40.50	45.00
St. Louis	12.00	*36.00*	38.00
San Francisco	12.00	45.00*	.....
Seattle	14.00	48.50†	61.00‡

*2½x8½x4 in. †2½x8½x4. ‡3½x8½x4.

FACE BRICK—Price delivered to job, New York, average grade, rough, red, per thousand $30.00

LIME—Prices delivered by dealers to job:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
Atlanta	$23.00	$15.50	.....	.....
Baltimore	22.00	14.00	$2.55†	.....
Birmingham	22.00	16.00	3.00†	$2.00†
Boston	22.00	14.00	4.00*	3.10*
Chicago	17.00	14.50	15.00‡	15.00‡
Cincinnati	13.05	10.70	.....	.....
Cleveland	14.00	12.00	2.50†	2.50†
Dallas	20.00	.....	2.35†	.....
Denver	32.00	23.75	3.80*	3.00*
Detroit	18.00	14.80	2.20†	2.00†
Kansas City	22.00	12.50	3.00†	2.50†
Los Angeles	18.90	16.00	2.85†	14.00‡
Minneapolis	25.50	21.00	.....	1.70†
Montreal	19.75	.....	.....	15.00‡
New Orleans	25.00	15.50	2.65†	1.95†
New York	21.00	**15.50**	4.10*	3.15*
Philadelphia	22.00	15.00	.....	.....
Pittsburgh	20.00	15.00	4.25*	.....
St. Louis	24.00	18.00	15.00‡	2.75†
San Francisco	20.00	20.00	.....	1.85†
Seattle, paper sacks	35.00	24.00	.....	2.80†

*Per 280-lb. bbl. (net). †Per 180-lb. (net). ‡Per ton.

LIMESTONE—Blocks, f.o.b. siding, New York, per cu.ft.:

Run of quarry	$1.27	Standard	$1.57
Rustic buff	1.42	Selected gray	1.57
Standard gray	1.47	Selected buff	1.67

SLATE—Roofing, f.o.b., quarry, Bangor, Pa., net, per square:

No. 1 Clear	$9.00@$14.00
No. 1 Ribbon	7.50@ 10.25
Medium Clear	8.00@ 10.50

Road and Paving Materials

PAVING STONE—Carload lots of granite blocks, 4x8x4-in., dressed, f.o.b.:

Atlanta	$3.00 per sq.yd.
Baltimore	3.00 per sq.yd.
Boston	135.00 per M.
Chicago, 5 in	3.25@3.90 per sq.yd.
Cincinnati	110.00 per M.
Cleveland	115@120 per M.
Detroit, 5 in	3.00 per sq.yd.
Kansas City	3.00 per sq.yd.
Minneapolis, 4½x8x5 in	2.80 per sq.yd.
Montreal	104.75 per M.
New Orleans	2.80 per sq.yd.
New York, 5 in., Grade 1, 30 blocks per sq.yd	150.00 per M.
Philadelphia	125.00 per M.
St. Louis, 4x5x8 to 12 in	3.50 per sq.yd.

Current Prices of Construction Materials

Road and Paving Materials—Continued

WOOD-BLOCK PAVING—Prices, f.o.b., in carloads:

	Size of Block	Treatment	Per Sq.Yd.
Atlanta	3½	16	$2.25
Boston	3½	16	2.25
Chicago	3½	12	2.00
Cincinnati	3½	16	2.35
Kansas City	3½	16	2.75
Minneapolis	3½	16	2.75
Montreal	4	16	4.50
New Orleans	3½	16	2.40
New York	3½	16	2.50
St. Louis	3½	16	2.10

FLAGGING—Alongside dock, New York: Manhattan and Bronx, 4 ft. wide, 24c. per sq.ft.; Queens, 5 ft. wide, 26c. per sq.ft.

CURBING—*New York*: Bluestone, f.o.b. barge, 5x16 in., rough, 90c. per lin.ft., cutting charges extra. *Birmingham*: Limestone, 5x18-in., f.o.b., $1.05 per lin.ft. *St. Louis*: Class "B" straight, 5x16-in., f.o.b., $1.00 per lin.ft.; roundings, $1.35 per lin.ft.

ASPHALT—Manufacturers' quotations per ton in packages (350-lb. bbls. or 425-lb. drums), also in tank-car lots, f.o.b. points listed:

	Package	Tank-car or Bulk
Atlanta	$20.40	*$16.40*
Baltimore	21.75	17.75
Birmingham	27.00	23.00
Boston	23.00	18.00
Chicago	23.50	19.30
Cincinnati	.....	12.30
Cleveland	24.00	20.00
Dallas	24.40	20.00
Denver	35.00	.....
Detroit	19.72	14.87
Kansas City	*28.00*	*23.00*
Los Angeles (f.o.b. refinery)	18.00	12.00
Maurer, N. J. (Bermudez)	30.00	.....
Maurer, N. J. (Trinidad)	25.00	.....
Minneapolis (f.o.b. Twin Cities)	23.10	*18.10*
Montreal	28.00	21.50
New Orleans	24.00	21.00
New York (f.o.b. refinery)	16.00	12.00
Philadelphia	17.00	13.00
Pittsburgh	24@26	14@18
St. Louis	22.50	18.50
San Francisco (f.o.b. refinery)	18.00	12.00
Seattle	21.40	18.00

ROAD OILS—Manufacturers' quotations, f.o.b., in tank cars, 8,000 gal. minimum, per gal.:

Birmingham, 40@50% asphalt	$0.0525
Birmingham, 50@60% asphalt	.0525
Dallas, 40@50% asphalt	.06
Dallas, 50@60% asphalt	.06
New York, 40@50% asphalt	.05
New York, 50@60% asphalt	.05
St. Louis, 40@50% asphalt	.04
St. Louis, 50@60% asphalt	.04

Iron and Steel

PIG IRON—Producers' quotations, per gross ton, f.o.b.:

Birmingham, No. 2 fdry., silicon, 1.75@2.25	*$13.00*	$14.00
Pittsburgh, basic, incl. freight ($1.76) from Valley		*18.76*

STRUCTURAL STEEL—Manufacturers' and dealers' quotations per 100 lb.

	Shapes, 3 to 15-In.	Plates, ¼-In.
Birmingham, large mill lots, f.o.b.	$2.15	$2.15
Chicago, warehouse, delivered	3.00	3.00
Cleveland, warehouse, delivered	*2.95*	3.00
Dallas, warehouse, delivered	3.90	4.00
New York, warehouse, delivered, 400 to 3,999 lb.	3.10	3.10]
Pittsburgh, large mill lots, f.o.b.	**1.65**	**1.65**
St. Louis, warehouse, delivered	3.25	3.25
San Francisco, warehouse, delivered	3.40	3.40

BARS, CONCRETE REINFORCING—Manufacturers' and dealers' quotations on bars rolled from billets, per 100 lb. for ½-in.:

Birmingham, large mill lots, f.o.b.	$2.15
Chicago warehouse, delivered	2.15@3.00
Cleveland, warehouse, delivered	2.25@2.44
Dallas, warehouse, delivered	2.50
New York, warehouse, delivered, over 5 tons	*2.35*
Pittsburgh, large mill lots, stock lengths, f.o.b.	**1.75**
St. Louis, warehouse, delivered	3.15
San Francisco, warehouse, delivered	2.50

EXPANDED METAL LATH—Per 100 sq.yd., painted, delivered to job, in lots under 200 sq.yds:

Lb. per Sq.Yd.	New York	Birmingham	Chicago	St. Louis	Dallas	San Francisco
2.2	$15.50	$22.00	$10.10*	$18.00@19.00	$18.00	$21.50
2.5	16.50	23.00	10.90*	19.00@20.00	19.50	22.50
3.0	18.00	25.00	12.25*	20.50@21.50	.....	25.00
3.4	19.00	26.50	13.10*	21.50@22.50	24.00	27.00

*More than 200 sq.yds.

WIRE REINFORCEMENT FOR CONCRETE—Plain, per 100 sq.ft., 4 in. x 4 in. mesh; manufacturers' quotations are in carloads at mills; dealers' are delivered in lots of 10,000 sq.ft. or over:

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Chicago District Mill	Del. From Warehouse: New York	St. Louis	Dallas	San Francisco
032	22	*$0.94*	*$0.96*	*$1.32*	$1.30	$1.63	$1.22*
049	28	*1.20*	*1.23*	*1.67*	1.70	2.00	1.55*
068	35	*1.46*	*1.50*	*2.07*	2.10	2.25	1.91*
093	45	*1.88*	*1.93*	*2.65*	2.65	2.86	2.46*
126	57	*2.33*	*2.38*	*3.28*	3.30	3.52	3.03*
153	68	*2.77*	*2.84*	*3.92*	4.00	4.20	.....
180	78	*3.18*	*3.26*	*4.49*	4.60	4.80	.....

* F.o.b.

STEEL SHEETS—Manufacturers' and dealers' quotations per 100 lb. base:

	Blue Annealed No. 10*	Black No. 24	Galvanized No. 24
Chicago, warehouse, delivered	$3.35†	$3.80†	$4.35†
Cleveland, warehouse, delivered	3.00	3.60	4.20
New York, warehouse, delivered	*3.25*	*3.50*	*4.00*
Pittsburgh, large mill lots, f.o.b.	1.90	2.35@2.45	2.90@3.00
St. Louis, warehouse, delivered	3.45	4.05	4.60
San Francisco, warehouse, delivered	3.80	4.35	4.85

*Light plates. †400 lb. to 3,999 lb.

WIRE ROPE—Discounts from manufacturers' list price on regular grades of bright and galvanized, Eastern Territory, New York, and East of Missouri River.

	Base
Cast steel round strand rope	20%
Galvanized iron rigging and guy rope (add to list)	12½%
Galvanized steel rigging and guy rope	7½%
Plow steel round strand rope	35%
Round strand iron and iron tiller	5%
"Special Steel" and extra strong cast steel, round strand rope	27½%

Discount 5 points less than discount for Eastern territory: California, Oregon, Nevada, Washington, Wyoming, New Mexico, Colorado, North Dakota, Nebraska, Kansas, Oklahoma and Texas. Discount 10 points less than discount for Eastern territory: Arizona, Montana, Idaho and Utah.

RIVETS—Manufacturers' and dealers' quotations on structural rivets, round head, ½-in., full kegs, per 100 lb.:

Chicago, warehouse, delivered	$4.00
Dallas, warehouse, delivered	5.00
Denver	*4.65*
New York, warehouse, delivered	*4.25*
Pittsburgh, large mill lots, f.o.b.	2.75
St. Louis, warehouse, delivered	4.15
San Francisco, warehouse, delivered	5.00
Seattle, warehouse, delivered	5.00

STEEL SHEETPILING—Manufacturers' base price, f.o.b., Pittsburgh, for large mill lots, per 100 lb. *$1.90*

TERNE PLATE—I C, 8-lb. coating, 20x28-in., f.o.b., Pittsburgh mill:
Per package $10.30

SHIP SPIKES—Per 100 lb., black, from dealers' warehouse stocks; galvanized are about $1.75 per 100 lb. higher:

	½-In.	⅝-In.	¾-In.
San Francisco	$5.50	$5.05	$4.90
Seattle	7.75	5.65	5.50

Pittsburgh mill base in lots of 200 kegs or more, $3.00 per 100 lb.

WIRE NAILS—Per 100 lb. keg, base, delivered from warehouse stocks; also Pittsburgh mill base:

Pittsburgh Mill	Birmingham	Chicago	St. Louis	Dallas	San Francisco	Montreal
$1.95@$2.00	$3.30	$3.30	**$2.50**	$3.50	$3.25	$4.95

SCRAP—The prices following are, f.o.b., per ton, paid by dealers:

	New York Per Gross Ton	Chicago Per Gross Ton	Detroit Per Gross Ton
No. 1 railroad wrought	**$8.75**	*$9.50@$10.00*	.....
Stove plate	4.75@**5.50**	8.50@ 9.00	*$6.00*
No. 1 machinery cast	8.00	11.25@ 11.75	*8.50**
Machine shop turnings	3.00	*5.00@ 5.50*	*4.00*
Cast borings	3.50	*5.00@ 5.50*	**6.00**
Railroad malleable	**9.50**	*12.75@ 13.25*	**11.00**
Re-rolling rails	*9.25*	*12.25@ 12.75*	10.00
Re-laying rails, 56@60 lb.	23.00	23.00@ 25.00	11.50
Heavy melting steel, No. 1	*7.00*	*10.00@ 10.25*	10.00
Iron and steel pipe	7.25	6.00@ 6.50	.....

*Net ton.

FREIGHT RATES—The following freight rates per 100 lb., effective May 20, 1930, apply on finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc.:

Atlanta	$0.58*	Detroit	$0.265†
Baltimore	.27†	Kansas City	.695†
Birmingham	.58*	New Orleans	.67*
Boston	.40†	New York	.33†
Buffalo	.235†	Pacific Coast (all rail)	1.15‡
Chicago	.34†	Philadelphia	.29†
Cincinnati	.265†	St. Louis	.39†
Cleveland	.185†	St. Paul	.60*
Denver	1.15‡		

*36,000 lb. †40,000 lb. ‡60,000 lb.

Railway Materials and Supplies

STEEL RAILS—Manufacturers' quotations per gross ton, f.o.b., for large mill lots:

	Pittsburgh	Birmingham	Chicago
Standard openhearth rails, 110 lb.	$43.00	$43.00	$43.00
Light rails, 25 to 45 lb.	34.00	34@36	34@36
Re-rolled rails	24@28	34@36	34@36

RAILWAY TIES—For fair-sized orders, f.o.b., the following prices per tie hold:

		6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
New York	Long-leaf sap pine, untreated	*$1.00*	$1.20
	Creosoted—prices on application.		
Birmingham	White oak, creosoted	1.52	1.75
	Southern pine, creosoted	1.25	1.60
Chicago	White oak, untreated	1.35	1.70
	Oak, empty cell, creosoted	1.75	2.30
	Oak, zinc treated	1.55	2.05
	Southern pine, creosoted	1.45	1.90
St. Louis	White oak, untreated	*.95*	*1.45*
	Red oak, creosoted	*1.25*	*1.80*
	Sap pine or cypress, untreated	*.65*	*1.10*
San Francisco	Douglas fir, green, untreated	*.65*	.92
	Douglas fir, empty cell, creosoted	1.41	2.15
Montreal	Birch or maple, untreated	.75@1.25	.75@1.25
	Birch or maple, creosoted	1.20@1.30	1.50@1.60

Current Prices of Construction Materials

Railway Supplies—Continued

TRACK SUPPLIES—Manufacturers' and dealers' quotations per 100 lb. f.o.b., Pittsburgh mill, for large mill lots, together with warehouse prices at other places named:

	Pittsburgh	Chicago	Birmingham	St. Louis	San Francisco
Standard spikes, ⅜-in. and larger	$2.80	$3.55	$3.45	$3.65@*3.85*	$4.10
Track bolts	3.80	4.55	5.85	4.50@ 5.00	5.10
Standard section angle bars, splice bars or fish plates	2.75	3.40	3.75	.....	.....

Tie plates: Price at Pittsburgh mill, *$1.95* per 100 lb.

Pipe

WROUGHT-STEEL PIPE—Discounts from manufacturers' and dealers' standard lists:

	1 to 3-In. Butt Weld		3½ to 6-In. Lap Weld	
	Black	Galvanized	Black	Galvanized
Chicago, warehouse, delivered	57.3%	44.8%	53.9%	41.4%
Cleveland, warehouse, delivered	53.3%	42.3%	50.8%	37.8%
New York, warehouse, delivered	56.14%	43.6%	52.72%	40.18%
Pittsburgh, large mill lots, f.o.b.	64%	52.5%	61%	49.5%
St. Louis, warehouse, delivered	51%	38%	48%	35%

CAST-IRON PIPE—Prices of U. S. Pipe & Foundry Co., per net ton, for bell and spigot pipe, Class B and heavier, f.o.b., on regular lots of pipe:

	4-In.	6-In. and Over
Birmingham mill	$40.00@$41.00	$37.00@$38.00
Burlington (N. J.) mill	*38.50@ 39.50*	*35.50@ 36.50*
Chicago	48.20@ 49.20	45.20@ 46.20
New York	*41.40*	*38.40*
Pittsburgh	48.80@ 49.80	45.80@ 46.80
St. Louis	*46.80@* 47.80	*43.80@* 44.80
San Francisco	50.00@ 51.00	47.00@ 48.00

Gas pipe and Class A, $3.00 per ton extra.

SEWER PIPE—Prices delivered, per foot, for standard pipe; 6, 8 and 12-in. are single strength and 18, 24, 30 and 36-in. are double strength:

	6-In.	8-In.	12-In.	18-In.	24-In.	30-In.	36-In
Atlanta	*$0.105*	*$0.175*	*$0.315*	.....	.....	.....	.....
Baltimore	.10	.30	.58	.....	$1.93	.....	$6.50
Birmingham	.25	.40	.65	$1.50	2.75	$3.90	5.85
Boston	.18	.28	.55	1.35	2.35	3.90	6.50
Chicago	.18	.28	.54	1.25	2.25	4.75	6.00
Cincinnati	.135	.21	.405	1.125	2.025	3.672	5.74
Cleveland	.189	.294	.567	1.35	2.43	4.824	7.38
Dallas	.23	.325	.586	1.106	1.95	3.68	5.00
Denver	.161	.23	.414	.816	1.44	.....	.....
Detroit	.18	.28	.6075	1.50	2.70	5.12	.....
Kansas City	.15	.29	.52	1.22	1.90	3.60	.....
Los Angeles	.21	.29	.52	1.186	2.03	3.39	5.09
Minneapolis	*.155*	*.24*	.50	1.15	1.85	*3.45*	*4.60*
Montreal	.36	.53	.78	1.48	2.75	4.20	.....
New Orleans	.18	.30	.54	1.02	1.95	.....	.....
New York	.17	.265	.52	1.30	2.34	4.47	6.86
Philadelphia	.117	.182	.351	1.05	1.89	3.60	5.6375
Pittsburgh	.09	.14	.27	.75	1.35	3.024	4.8175
St. Louis	.1645	.26	.468	1.092	1.872	3.65	4.80
San Francisco	.1925	.275	.495	1.155	1.98	3.30	4.95
Seattle	.22	.30	.54	1.26	2.16	3.50	5.50

CLAY DRAIN TILE—Prices delivered by dealers, per 1,000 lin.ft.:

Size, In.	New York	Birm'ham	St. Louis	Dallas	San Fran.	Seattle
4	$45.00*	$56.00	$50.00	$63.00	$67.50	$60.00
6	80.00*	112.00	85.00	100.00	112.50	112.00

*F.o.b.

Miscellaneous

LINSEED OIL—Raw oil, f.o.b., in 1- to 4-bbl. lots, per lb.:
New York.... **$0.096** Chicago.... $0.098 Minneapolis...$0.101

WHITE AND RED LEAD—Base price per 100-lb. keg, f.o.b., New York: White, dry, *$13.25*; White, in oil, *$13.25*; Red, dry, *$13.25*; Red, in oil, *$14.75*.

CHEMICALS—Water, sewage treatment, road work, round lots in the New York market:

Sulphate of aluminum, in bags, per 100 lb	$1.40@$1.45
Sulphate of copper, in bbl., per 100 lb	*4.00@ 4.25*
Soda ash, 58%, in bags, per 100 lb	*1.15@1.17½*
Chlorine, cylinders, per lb	.04@ .06
Bleaching powder, in drums, f.o.b. works, per 100 lb	2.00@ 2.10
Calcium chloride, flaked, in drums, f.o.b. works, per ton	22.75

MANILA ROPE—The number of feet per pound for the various sizes is as follows: 5-in., 7-ft., 6-in.; ¾-in., 6-ft., 1-in.; ⅝-in., 4-ft., 5-in.; 1-in., 3-ft., 8-in.; 1¼-in., 2-ft., 5-in.; 1¼-in., 1-ft., 8-in. Following prices are quoted by dealers per pound for ¼-in. and larger:

Atlanta	*$0.27*	Kansas City	$0.25
Baltimore	.225	Los Angeles	.25
Birmingham	.26	Minneapolis	.19
Boston	.21	Montreal	.185
Chicago	.17	New Orleans	.25
Cincinnati	.21	New York	*.19*
Cleveland	.21	Philadelphia	.21
Dallas	.26	San Francisco	.175
Denver	*.20*	Seattle	.195
Detroit	.225	St. Louis	*.175@.18*

BUILDING PAPER—Black, 50-lb. per roll of 500 sq.ft., in carloads, f.o.b., producing point $2.16

SLATERS FELT—In carloads, per roll, f.o.b., producing point $0.79

ROOFING MATERIALS—Prices, f.o.b. New York, delivered by dealers to contractors, in carloads:

Asphalt felt, per 100 lb	$3.00
Tar felt, per 100 lb	3.00
Asphalt coating, per gal	.34½
Tar pitch, in 350 lb. barrels, per ton	28.00

PREPARED ROOFINGS—Prices, delivered by dealers to contractors, in car loads, f.o.b. New York, per square:

Single shingles, slate finish, sufficient to cover 100 sq.ft.	$6.1
Strip shingles, 4 in 1, hexagonal shape, with Underwriters' label	6.0
Slate surfaced roofing in rolls weighing 85 to 90 lbs	2.5

WINDOW GLASS—United inches 25, bracket size 6x8 to 10x15, single or double thickness, discount from jobbers' list (Sept. 15, 1928), at New York warehouses:
AA..... 83% A..... 89% B..... 91%

EXPLOSIVES—Manufacturers' quotations per pound for dynamite delivered in small lots—under 200 lb.:

	Gelatin 40%	Gelatin 60%		Gelatin 40%	Gelatin 60%
Atlanta	$0.22	$0.245	Los Angeles, f.o.b.†	$0.1875	$0.2225
Baltimore	.215	.2375	Minneapolis	.20	.225
Birmingham	.22	.245	Montreal	.20	.24
Boston	.225	.255	New Orleans	.195	.22
Chicago	.195*	.22*	New York	*.25‡*	*.2725‡*
Cincinnati	.22	.245	Philadelphia	.215	.24
Dallas	.2125	.2475	St. Louis	.215	.235
Denver, f.o.b.	.19	.2125	San Francisco	.155	.18
Kansas City, Mo.	.2025	.2225	Seattle	.1525	.175

*Quantities above 500 lb. but less than a ton. †San Fernando Arsenal. ‡Special gelatin in case lots.

Lumber

Prices Are Per Thousand Feet, Board Measure

New York—Timbers, No. 1 Common, rough, delivered to contractor at site of job, in Manhattan, in 20 ft. lengths and under, per M. ft., b.m.:

	Long-leaf Yellow Pine	Douglas Fir
3x4 to 8x8	$52.50	$35.00
3x10 to 10x10	65.00	36.00
3x12 to 12x12	73.00	37.00
3x14 to 14x14	85.00	42.50

Chicago—Prices, f.o.b., in carloads, No. 1 Common, rough, per M. ft. b.m. For delivery to job from stock, in truckloads, add $10 per M. ft., b.m.:

	20 Ft. and Under Long-Leaf Yellow Pine	Up to 32 Ft. Douglas Fir
3x4 to 8x8	$41.50	$39.50
3x10 to 10x10	49.00	39.50
3x12 to 12x12	61.00	39.50
3x14 to 14x14	73.00	40.50

San Francisco—Douglas fir, No. 1 common, rough, at yards. For delivery to contractor at site of job, add $1.50 to $5 per M. ft., b.m.:

	10-16-18 and 20 Ft.	22 and 24 Ft.
3x3 and 4	$30.00	$32.00
3x6 and 8	30.00	32.00
3x10 and 12	30.00	32.00
3x14	33.00	34.00

Other Cities—Delivered by dealers, No. 1 Common, rough, per M. ft., b.m.:

	8x8-In. x 20 Ft. and Under				3x12 to 12x12-In. 20 Ft. and Under	
	Pine	Fir	Hemlock	Spruce	Pine	Fir
Atlanta	$55.00	.....	.....	.....	$65.00	.....
Baltimore	36.00	$50.00	$53.50	$61.75	75.00	$50.25
Birmingham	53.00	.....	.....	.....	56.50	.....
Boston	52.00	45.00	*47.00*	48.00	58.00	42.00
Cincinnati	42.50	55.00	.....	.....	52.50	52.50
Cleveland	54.00	58.00	.....	.....	58.00	62.00
Dallas	55.00	57.50	55.00	55.00	55.00	50.00
Denver	.....	50.00	**50.00**	**50.00**	.....	47.00@55.00
Detroit	53.00	51.00	.....	.....	67.00	51.00
Kansas City	36.00	34.00	.....	.....	50.00	34.00
Los Angeles	.....	43.50	.....	.....	.....	45.50
Minneapolis	.....	46.25	.....	.....	.....	46.25@47.75
Montreal	50.00	48.00	.....	.....	56.00	48.00
New Orleans	44.00	40.00	.....	45.00	65.00	60.00
Philadelphia	50.00	42.00	41.00	46.00	58.00	43.00
Pittsburgh	*53.00*	*57.00*	65.00	66.00	*53@65*	**60@**62
St. Louis	53.00	**41.00**	**41.00**	.....	**59.50**	*40.00*
Seattle	.....	21.00	.....	.....	.....	**21.00**

	1x10 In. x 16 Ft. and Under			2x10 In. x 16 Ft. T. & Gr.	
	Pine	Fir	Hemlock	Pine	Fir
Atlanta	$55.00	.....	.....	$40.00	.....
Baltimore	55.00	$44.50	$44.00	.....	.....
Birmingham	36.00	.....	.....	45.00	.....
Boston	47.00	40.00	*42.00*	48.00	$44.00
Cincinnati	45.00	47.50	.....	35.00	45.00
Cleveland	65.00	65.00	.....	42.00	54.00
Dallas	60.00	.....	.....	55.00	.....
Denver	40.50	38.00	38.50	.....	44.00
Detroit	47.00	44.00	.....	47.50	45.50
Kansas City	46.00	33.25	.....	40.25	36.25
Los Angeles	40.50	40.50	.....	.....	48.50
Minneapolis	65.00*	40.00	.....	45.00*	39.00
Montreal	56.00	.....	.....	.....	.....
New Orleans	54.00	48.00	.....	40.00	40.00
Philadelphia	52.00	42.00	40.00	53.00	42.00
Pittsburgh	43.00	*50.00*	55.00	40.00	*50.00*
St. Louis	*42.00*	42.00	42.00	46.00	43.00
Seattle	.....	18.00	.....	.....	18.00

*Northern Pine, No. 2 Com.

PILES—Prices of Nichols Bros., 90 West St., N.Y.C., per lineal foot, pine, with bark on, f.o.b., New York; delivered from barge, 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.13½	$0.18
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.18	.23
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.20½	.25
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.24	.36
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.25½	.31
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.32	.41
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	.36	.45

Current Construction Unit Prices

Highway Trestle Bridge in California

A TIMBER trestle bridge 2,476 ft. 7¾ in. long will be built by the California division of highways across Richardson Bay and over the tracks of the Northwestern Pacific R.R. at Manzanita, in Marin County. The bridge consists of a 56-ft. plate-girder lift span on concrete piers with pile foundations, one 45-ft. steel-stringer span on concrete bents and pile foundations, and 2,340 ft. of timber trestle (23-ft. spans) on pile and frame bents. The roadway is 44 ft. 4 in. wide. Paving for the trestle is asphalt concrete; for the steel stringer span, concrete; and for the lift span, asphalt plank. Probable lengths of piles are 36 ft. at the north end of the structure and 36 to 106 ft. throughout. Where the length exceeds 105 ft. splicing is permitted, with spliced piles paid for at the 85-ft. price.

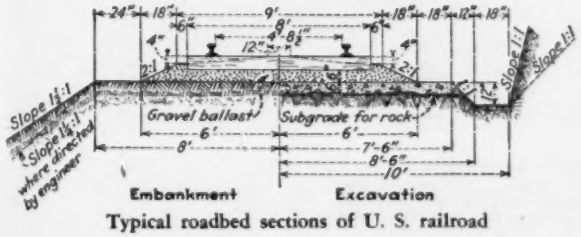
Sixteen bids were received; unit prices are given of the lowest three: A, Healy, Tibbitts Construction Co., San Francisco (contract); B, H. W. Rohl Co., Los Angeles; C, Frederickson & Watson Construction Co. and Frederickson Bros., Oakland.

	A	B	C
70 cu.yd. structure excavation	$2.00	$5.00	$8.50
Test piles in place (lump sum)	1,000.00	4,000.00	650.00
Furnish untreated Douglas fir piles:			
2,500 lin.ft. under 45 ft	.25	.25	.23
6,200 lin.ft., over 44 ft	.25	.25	.26
Furnish creosoted Douglas fir piles:			
2,600 lin.ft., under 45 ft	.70	.70	.68
2,520 lin.ft., 45-64 ft	.70	.80	.75
17,900 lin.ft., 65-84 ft	.75	.90	.78
28,600 lin.ft., over 84 ft	.80	1.00	.90
Furnish redwood piles:			
3,100 lin.ft., under 85 ft	.60	.90	.68
29,750 lin.ft., over 84 ft	.70	.90	.85
1,138, driving timber piles	12.00	15.00	16.00
1,900 lin.ft. reinforced concrete piles	3.00	3.00	3.00
50 tons gravel backfill	3.00	3.00	2.50
Concrete:			
66 cu.yd. class A (tremie)	20.00	54.00	22.50
580 cu.yd. class A (structure)	25.00	15.00	17.00
455 cu.yd. class B	22.00	15.00	17.00
72,000 lb. reinforcing steel	.05	.04	.04
315,000 lb. structural steel	.065	.05	.07
5,200 lb. cast steel	.15	.10	.12
1,600 M. bd.ft. redwood timber, str. grade	80.00	82.00	82.00
520 M.bd.ft. redwood timber, select str. grade	85.00	80.00	81.00
10.5 M.bd.ft. Douglas fir timber, select str. gr.	75.00	100.00	75.00
1,300 tons asphalt concrete pavement	6.00	4.00	5.75
280 sq.yd. asphalt plank	3.00	3.00	3.50
Operating machinery (lump sum)	9,000.00	4,000.00	9,500.00
Misc. items work (lump sum)	1,700.00	500.00	700.00
Total	$329,668	$333,335	$340,972

Construction Railroad and Road to Hoover Dam

BIDS were opened on U. S. railway from Boulder City, Colo., to Hoover Dam, Nev., on Jan. 12, 1931, and the contract was awarded on the low price of $455,510 submitted by the Lewis Construction Co., Los Angeles. The railway is 10½ miles long, and the principal items of work are 202,000 cu.yd. of rock excavation for roadbed at $0.82, and 26,000 cu.yd. of tunnel excavation at $2.80.

Roadbed sections are shown in the drawing. Embankments are formed of roadbed excavation and are built by dumping from grade. Other earth-moving items are 574,000 cu.yd. of overhaul and 384,000 cu.yd. of long-haul borrow. The long-haul material is taken from pits in Hemenway, Wash., and brought by truck or car to the site. The contractor's estimate was 16c. per cubic yard mile, and the average of the twelve bids received was 16¼c. Tunnel work is in five parts totaling 1,705 ft., all located in a 4,500-ft. section of the line. Tunnels are 18 ft. wide by 17 ft. to springline, radius 9 ft. Concrete is 1:2.4:3.6. The last item is 20,400 cu.yd. of ballasting, of pit-run gravel containing no cobbles of more than 3 in. The contract price is $1 per cubic yard; the average, $1.10.



Typical roadbed sections of U. S. railroad

TABLE I—U. S. RAILROAD FROM BOULDER CITY TO HOOVER DAM

	A	B	C
270,000 cu.yd. excav. for roadbed, common	$0.22	$0.27	$0.24
202,000 cu.yd. excav. for roadbed, rock	.80	.77	.76
574,000 sta. c.y. overhaul	.02	.0075	.01
221,500 cu.yd. excavating and loading long-haul borrow	.15	.14	.14
384,000 c.y.mile hauling and spreading long-haul borrow	.16	.12	.10
26,000 cu.yd. excav. of tunnels	2.80	3.40	4.60
180 M. ft. b.m. erecting permanent timbering in tunnels	10.00	17.00	15.00
700 cu.yd. excav. for structures, common	.60	.50	.50
1,000 cu.yd. excav. for structures, rock	2.50	1.80	1.50
5,500 cu.yd. backfill about structures	.50	.40	.60
200 cu.yd. concrete	20.00	17.00	22.00
15,000 lb. placing reinforcement bars	.01	.02	.01
4,500 sq.yd. dry rock paving	.50	2.00	1.50
2,500 cu.yd. furnishing, erecting and filling conc. crib walls	3.00	5.00	3.00
1,400 lin.ft. laying 24-in. dia. corr. metal pipe	.50	.30	.40
100 lin.ft. laying 30-in. dia. corr. metal pipe	.50	.50	.50
160 lin.ft. laying 36-in. dia. corr. metal pipe	.70	.85	.50
260 lin.ft. laying 42-in. dia. corr. metal pipe	1.00	1.25	.60
180 lin.ft. laying 48-in. dia. corr. metal pipe	2.00	1.50	.70
580 lin.ft. laying 60-in. dia. corr. metal pipe	3.00	1.75	.80
25 M. ft. b.m. erecting timber in bridges or trestles	20.00	35.00	16.00
2,000 lin.ft. driving piles	.50	.40	.60
10.23 trk. mile laying ties and track	750.00	1,600.00	3,200.00
6,800 applying rail anchors	.20	.08	.03
2 M. ft. b.m. placing crossing planks	20.00	20.00	10.00
20,400 cu.yd. ballasting	1.00	.85	.55
Totals	$455,509	$469,028	$486,936

TABLE II—HIGHWAY BOULDER CITY TO HOOVER DAM

Schedules, 30 Ft.	Ft. Long	A	B	C
1. Branch A	6,772	$35,499	$43,898	$45,185
2. Branch B	9,100	23,200	31,931	27,251
3. Branch C	28,100	335,560	333,122	341,408
1-2-3	43,972	$394,259	$408,951	$413,844
22 Ft.				
4. Branch A		$28,912	$38,293	$38,276
5. Branch B		18,256	26,943	22,155
6. Branch C		282,749	288,494	289,512
		$329,917	$353,730	$349,943

In Table I unit prices are given of the lowest three bidders: A, Lewis; B, J. F. Shea Co., Portland, Ore.; C, Merritt-Chapman & Scott Corp., San Pedro, Calif.

By another contract a road also will be built between Boulder City and the dam. The base is compacted gravel or crushed rock, with compacted oil-treated surfacing. Bids were asked on surfacing 30 ft. wide and 20 ft. wide, in three schedules for each width. A summary of the lowest three bids is given in Table II. The bidders are: A, General Construction Co., Seattle (contract); B, R. G. LeTourneau, Inc., Stockton, Calif.; C, Utah Construction Co., Ogden, Utah, and Morrison-Knudson, Boise.

Dredging Indian River Section of Intercoastal Waterway, Fla.

THE intercoastal waterway from Jacksonville to Miami follows the line of the East Coast Canal, formed by a chain of shallow salt water lagoons and creeks and a series of artificial cuts connecting them. The Indian River section extends from the south end of "The Pocket," south of St. Lucie Inlet, to a point one mile south of the bridge at Melbourne, Fla., 69 miles. A channel will be dredged the entire distance, having a bottom width of 100 ft. with additional width at bends and bridges, and a depth of 8 ft. at mean low water. The work is laid out in two sections and the quantities of material and the allowable overdepth

in cubic yards are given below. The material is deposited on either bank of the channel, at least 600 ft. distant.

Section	Soft Material	Rock	Total
1	673,000	none	673,000
2	1,463,000	3,000	1,466,000
Total	2,136,000	3,000	2,139,000
(Overdepth)			
1	481,000	none	481,000
2	780,000	6,000	786,000
Total	1,261,000	6,000	1,267,000

Eleven bids were received Nov. 1, 1930, and are tabulated below. Contract was let to the Clark Dredging Co., for $253,314. Estimated rate of removal per month is 280,000 cu.yd. for Sec. 1 and 225,000 cu.yd. for Sec. 2. Time to complete is 124 days for Sec. 1 and 301 days for Sec. 2. Lieut. Col. L. V. Frazier is district engineer, Jacksonville. The official tabulation of bids is given below:

	Soft Material			Rock		
	Sec. 1	Sec. 2	Both	Sec. 1	Sec. 2	Both
Reliable Dredging Co.	$0.1124	.....	.....	.....	.....	.....
Moody, Anderson & Milling Co.	.109	$0.109	$0.109	$1.20	$1.20	$1.20
Atlantic, Gulf & Pacific Co.	.....	.....	.1049	.....	.....	.1049
W. H. Gahagan Realty Co.	.117	.195	.....	6.00	4.00	.....
Arundel Corp.	.12	.13	.12	1.00	1.00	1.00
United Dredging Co.	.....	.....	.114	.....	.....	1.00
Clark Dredging Co.	.....	.....	.072	.....	.....	.97
McArdle Corp.	.074	.079	.077	.....	.....	.....
R. C. Hoffman Constr. Co.	.15	.13	.1225	2.50	2.50	2.50
Lukens Dredging & Contg. Co.	.1733	.1545	.....	1.70	1.70	.....
Central Dredging Co.	.....	.....	.1474	.....	.....	5.00
Average bids	$0.1222	$0.1329	$0.1083	$2.48	$2.08	$1.6821

Concrete Road in Florida

STATE road department, Tallahassee, Fla., opened bids Jan. 12 for 5.22 miles road from Lakeland to Carters, in Polk County. Unit prices are given of the lowest three bidders: A, J. J. Quinn, Inc., Miami (contract); B, Rutherford Construction Co., Inc.; C, H. E. Wolfe Construction Co.

	A	B	C
2.0 acres clearing and grubbing	$75.00	$100.00	$100.00
22,562 cu.yd. regular excav.	.35	.40	.34
834 sq.yd. 6-in. compacted rock base	1.00	.90	.85
834 sq.yd. single bitum. treatment	.30	.25	.25
69,388 sq.yd. plain cement conc.	1.82	1.83	1.91
6,376 lb. reinforcing steel	.05	.05	.05
11,632 lin.ft. comb. cem. conc. curb and gutter	.70	.65	.68
11,790 lin.ft. woven wire guard rail	.45	.45	.47
62,664 sq.yd. sprigging	.02	.025	.02
Total	$150,437	$151,916	$156,343

Sewage-Treatment Works for Lima, Ohio

IN MARCH, 1930, the city of Lima, Ohio, advertised for engineering services in connection with the design, construction and operation of its proposed sewage-treatment plant. The successful engineers, H. P. Jones & Co., Toledo, called for bids on the construction of the plant Nov. 18, and let contracts to Green & Sawyer, Main St., Lima, for $509,882. The work is divided into two contracts: (1) a two-span reinforced-concrete arch bridge over the Ottawa River; (2) the sewage-treatment works.

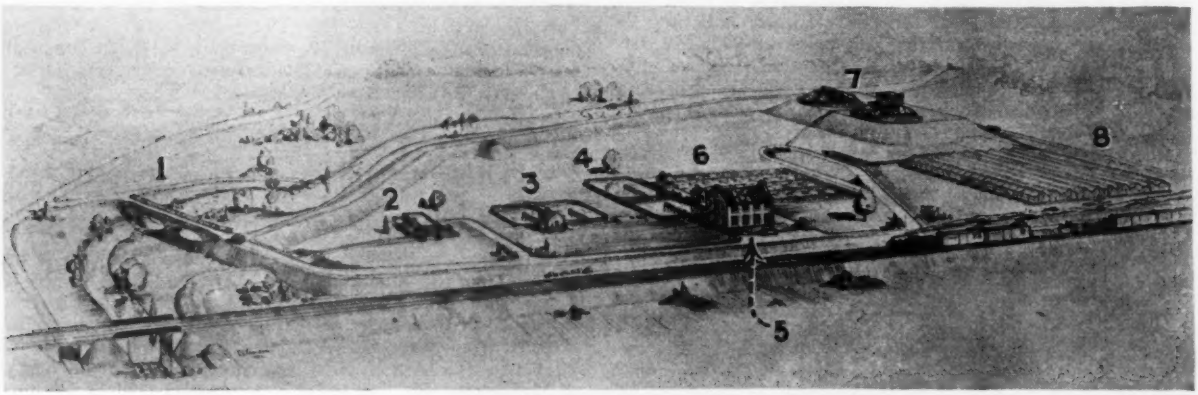
The bridge was bid lump sum, with prices for other work given below for the lowest four bidders:

	1	2	3	4 (contract)
Bridge	$15,516.00	$18,584.00	$18,700.00	$21,000.00
Earth excav.	1.25	1.35	1.00	1.25
Rock excav.	5.00	5.00	4.00	5.00
Class A conc.	13.00	15.60	18.00	12.00
Class B conc.	10.00	12.00	15.00	10.00
Reinf. steel	.03	.05	.04	.03
Sheeting in place	50.00	50.00	40.00	20.00
Steel sheeting, lb.	.03	.035	.05	.00
Riprap, sq.yd.	2.00	2.00	4.00	2.02

The layout of the treatment works consists of two preliminary tanks, two final tanks, aeration tanks, two digester tanks, and provision for double this capacity. Included also is a main building and glass-covered sludge beds 175⅔ x 200¾ ft. The bids cover 113 items and a number of alternates; principal items are given in the second tabulation. The largest item is 8,000 cu.yd. of concrete, costing $116,000. There are 62,000 cu.yd. of earth excavation, including removal, placing in embankments, and grading, estimated to cost 70@90c. per cubic yard. Rock excavation amounts to only 200 cu.yd., and average estimated costs of removal are $4@$6. Class A concrete has a strength of 2,500 lb. per sq.in. and the following quantities per cubic foot or sack of cement: 6¾ gal. water; 6 cu.ft. aggregate. Class B has a strength of 1,500 lb. with 8 gal. water, and 7½ cu.ft. aggregate per cubic foot of cement. Mortar concrete is 1:2.

Seventeen bids were received, and unit prices are given of the lowest three bidders: A, E. H. Latham, Columbus, $489,331; B, Boyajohn & Barr, Columbus, $495,540; C, Green & Sawyer, Lima, $487,627 (contract).

	A	B	C
62,000 cu.yd. earth excav.	$0.78	$0.94	$0.90
150 cu.yd. rock excav.	6.00	6.00	5.00
10 M. ft. b.m. sheeting and timbering in place	30.00	12.00	50.00
10,000 lb. steel sheeting left in place	.02	.03	.025
8,000 cu.yd. conc. class A	14.50	11.16	12.00
100 cu.yd. conc. class B	14.00	10.83	12.00
200 cu.yd. mortar conc.	12.17	8.35	12.00
2,400 sq.ft. precast conc. slabs	.20	.42	.20
200,000 lb. hydrated lime	.005	.006	.007
1,000,000 lb. reinf. steel (new billet)	.036	.035	.033
1,000,000 lb. reinf. steel (rail billet)	.0332	.032	.03
1,200 lb. reinf. steel mesh	.06	.0725	.10
12,000 sq.ft. granolithic surfacing	.06	.083	.10
7,000 sq.ft. machine surfacing	.06	.095	.10
4,000 sq.ft. mastic expansion joints	.14	.1425	.15
900 sq.yd. painted asphalt joints	.25	.30	.18
1,000 lb. copper expansion joints	.30	.48	.32
20,000 sq.ft. waterproofing	.03	.0525	.03
120 tons cast iron B. & S. pipe	90.00	60.00	70.00
10 tons cast-iron flanged pipe	125.00	108.00	110.00
30 tons cast-iron B. & S. specials	150.00	125.00	120.00
30 tons cast-iron flanged specials	200.00	189.00	170.00
7,000 lin.ft. 4 in. vitr. pipe drains	.15	.12	.16
1,000 lin.ft. 6 in. vitr. pipe drains	.25	.18	.22
3,000 lin.ft. 8 in. vitr. pipe drains	.38	.35	.43



Sewage-treatment works at Lima, Ohio

(1) concrete bridge, (2) power house, (3) preliminary tanks, (4) two final tanks, (5) main building, (6) aeration tanks, (7) two digesters, (8) glass-covered sludge beds.

CONSTRUCTION NEWS

CONTENTS

Engineering Structures	Page
Airports	65
Bridges	62
Dams	65
Equipment	66
Excavation	64
Federal Government	64
Federal Power Comn.	64
Foreign	66
Grade Crossings	65
Grain Elevators	65
Heating and Ventilating	65
Materials	65
Parks and Sports	65
Piers and Wharves	65
Power and Lighting	65
Railway	64
Sewers	61
Streets and Roads	63
Subways and Tunnels	65
Waste Disposal	62
Waterworks	61
Unclassified	65
Industrial Buildings	
Factories and Mills	68
Garages	68
Power Plants	68
Shops and Foundries	68
Warehouses	68
Commercial Buildings	
Banks	67
Churches	66
Clubs	66
Hospitals	66
Lofts	67
Offices	67
Public	67
Residential	66
Schools	66
Stores	67
Theatres	67
Unclassified	67

Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue.

Location	*Project*	*Cost*	*Status*
Bridges			
Indiana and Kentucky	Bridge	$5,000,000	Proposed
Chicago	Bridge	3,500,000	Proposed
Chicago	Bridge	2,700,000	Proposed
Grain Elevators			
Buffalo	Grain elevator	1,000,000	Proposed
Federal Government			
Lewisburg (Pa.)	Penitentiary	2,781,000	Contract
Factories and Mills			
Seattle	Assembly plant, etc	3,000,000	Contract
Buildings			
Oklahoma City	Bank and office	3,000,000	Contract
London (Ont.)	Hospital	1,000,000	Proposed
Long Island City	Boro Hall and courthouse	8,000,000	Proposed
Pittsburgh	Town Hall	6,000,000	Proposed
Chicago	School	2,000,000	Bids asked
New York	Art museum	3,350,000	Proposed
Toronto	Museum	1,500,000	Contract
Tulsa (Okla.)	Bus terminal, hotel, etc	1,500,000	Proposed
Atlantic City	Railroad terminal	6,000,000	Proposed

WATERWORKS

PROPOSED WORK

Ariz., Phoenix—Camelback Water Conservation Dist., rejected bids Jan. 6, eight 20 in. deep wells with turbine pumps, motors, 7 booster pumps, 8 mi. 11,000 volt transmission line, 100,300 lin.ft. 12- to 24-in. rein.-con. pipe, 12,540 lin.ft. metal pipe, rein.-con. reservoirs. Reed & Baker, Phoenix, Fleming Bldg., engrs. District will enter into private contract to construct the works. Noted Dec. 11.

Calif., Los Angeles — Los Angeles Co. soon takes bids drilling 10 diamond drill holes at site San Gabriel Dam, incl. **(a)** 140 lin.ft. holes in river wash, gravel and boulders **(b)** 300 lin.ft. holes in bedrock **(c)** 60 lin.ft. holes in any material, all above 100 ft. or less in depth, casings to be withdrawn from each **(d)** 310 lin.ft. holes in river wash, gravel and boulders **(e)** 150 lin.ft. holes in bedrock **(f)** 40 lin.ft. holes in any material, all above 100 ft. in depth, casings left in place. E. C. Eaton, ch. engr. County Flood Control Dist.

Mass., Sherborn—Town, Bd. Selectmen, waterworks. $25,000.

Mich., Jackson—Waterworks extension, incl. new Water St. Station, 5 m.g. reservoir, 4 wells, pumps with connections and feeder mains for distribution system. $380,000. W. B. Hodges, city mgr.

N. J., Haledon—Bd. Boro Council, Boro Hall, filtration plant at Haledon Reservoir. $120,000.

N. J., Hammonton—Bd. Town Council, Town Hall, extending mains in Main Rd., Bway., Pratt, Liberty, Peach, Vine and Grape Sts. $27,000. J. A. Baker, town engr.

N. J., Point Pleasant—Bd. Boro Council, Boro Hall, will not build waterworks. $15,000 or more. Project abandoned. Engineer not selected.

R. I., Barrington—Bristol & Warren Waterworks, Barrington, bids after Mar. 1, general and separate contracts distribution system. To exceed $100,000. Supervising Engineers, Inc., 42 Cedar St., New York, engrs. Noted Jan. 22.

Ont., Colborne — Village, waterworks, incl. wells, pumps, pumphouse, c.i. mains, valves, hydrants, services. $65,000. Contract for drilling wells, to Layne Canadian Water Supply Co., Metropolitan Bldg., Toronto. D. H. Fleming, Metropolitan Bldg., Toronto, engr.

Ont., Port Robinson — Thorold Twp., waterworks, incl. c.i. distribution system, valves, hydrants, electric pumps, services, c.i. pipe. $25,000. Ross & Scott, 6 Main St., Welland, engrs.

Ont., Windsor—City, 2 mi. mostly 6 in. c.i. mains, with valves, hydrants. $22,000. R. J. Desmarais, City Hall, engr.

BIDS ASKED

Idaho, Moscow — City Council taking bids 1,000 to 1,200 g.p.m. pump and 120 to 150 hp. diesel engine. H. Smith, city engr.

Ind., Ft. Wayne—Feb. 24, by Bd. P. Wks., City Hall, J. C. Trier, chn., 20 m.g. filtered water reservoir, Contr. 2. Hoad, Decker, Shoecraft & Drury, State Savings Bank Bldg., Ann Harbor, Mich., consult. engrs.; adv. E. N.-R. Feb. 12.

N. J., Trenton—Feb. 13, by City Comn., four flanged Rensselaer valves, upright, equipped with Dean Electric Control; 1 flanged Rensselaer valve, upright; 1 flanged Rensselaer horizontal swing gate valve, without bypass; 24 and 30 in. Class B American Water Works specifications, c.i. flanged pipe and fittings, for pumps at Calhoun Street Station. A. Bugbee, city engr.

N. Y., Massapequa—Feb. 21, by Bd. Water Comrs. Massapequa Water Dist., 331 Merrick Rd., new waterworks, incl. 30 mi. 6- to 12-in. c.i. mains, valves, hydrants, 300,000 gal. steel water tank on tower, 400 service connections. Clyde Potts, 30 Church St., New York, consult. engr.; adv. E. N.-R. Feb. 12. Noted Dec. 25.

N. Y., Maybrook—Feb. 19, by Bd. Village Trustees, T. A. Miller, clk., water system. H. W. Taylor, 11 Park Pl., New York, consult. engr.; adv. E. N.-R. Feb. 5.

Tex., Fort Worth — Feb. 24, by City, c/o O. E. Carr, enlarging filtration plant to 40 m.g. d.c. $450,000. Hawley, Freese & Nichols, 411 Capps Bldg., consult. engrs. Noted Dec. 18.

Wash., Seattle—Bd. P. Wks. bids about Mar. 13, 90 m.g. concrete lined reservoir, two 1¼ m.g. steel storage tanks, West Seattle Dist. $800,000. Separate contract for excavation. R. H. Thompson, Seattle, engr.

Wis., Whitefish Bay—Feb. 16, by Village clk., installing 10,600 lin.ft. 12 and 16 in. mains in North Richards St.; furnishing 705 tons 6- to 16-in. water pipe, 8 hydrants, eighteen 8- to 16-in. gate valves. T. F. Buckley, Whitefish Bay engr.

Que., Lachine—Feb. 19, by H. Daoust, esq., city clk., City Hall, pumping station, filter plant. Crepeau & Hunter, 1112 Dominion Square Bldg., Montreal, consult. engrs.

CONTRACTS AWARDED

Calif., Beverly Hills—City Council, furnishing, installing 3 booster pumps, to Byron Jackson Co., 2150 East Slauson St., Los Angeles; furnishing, installing deep well turbine pump, to Pomona Pump Co., 322 East 3rd St., Los Angeles. Noted Jan. 8.

Calif., Los Angeles—City Purchasing Agent, dipping riveted steel water pipe, incl. 2,520 ft. 48 in. x ¼ in., 3,629 ft. 45 in. x 1.4 in., 2,641 ft. 42 in. x ¼ in., to Lacy Mfg. Co., Washington Bldg., at $0.27 per ft. net.

Calif., San Bernardino—San Bernardino County Water Works Dist. 9, 2,000 ft. 20 in. Class B and S water pipe 16 ft. lengths, to Amer. Cast Iron Pipe Co., 412 West 6th St., Los Angeles, at $4.40 per ft. Noted Jan. 8.

Minn., Minneapolis—F. S. Gram, city purch. agt., to Columbian Iron Wks., 2501 Chestnut St., Chattanooga, Tenn., two hundred twenty-five 6 in. gate valves at $18.10 each, twenty-five 8 in. gate valves at $29 each, six 12 in. at $53.40 each; seventy-five fire hydrants at $70.20 each; to Waterous Co., 80 Fillmore Ave. E., St. Paul, twenty-five hydrants at $68.85 each. Noted Jan. 1.

Minn., Minneapolis—F. S. Gram, city purch. agt., two 750 lb. and three 360 lb. chlorinators for filtration plant, to Wallace & Tierman Co., 614 Flour Exch., $1,903 and $1,444 respectively. Noted Jan. 22.

N. Y., Long Beach—City Council, J. J. McCabe, clk., City Hall, Park Ave., water tank, to A. M. Hazell, Inc., 26 Courtlandt St., New York, $50,000.

N. Y., Long Island City—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in 19th and 21st Aves., to Bruno Cosanzo, 2777 Myrtle Ave., $7,000. Noted Jan. 15.

N. Y., New York—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Katonah Ave., to Bronx Water Wks., Inc., 1 Riverdale Ave., $7,375. Noted Jan. 22

Ont., Colborne—See "Proposed Work."

Ont., Ottawa—City, N. H. H. Lett, City Hall, filter equipment, to W. J. Westaway, 38 Main St. W., Hamilton, $142,840. Noted Dec. 11.

SEWERS

PROPOSED WORK

Calif., Los Angeles—For 707,000 lin. ft. sanitary sewers, pumping plants, manholes, house connections, various sections city. F. L. Weisenheimer, assistant ch. engr. Sanitary Sewer Dpt., City Hall. **Maturity this year.**

Md., Baltimore—Bd. Estimates approved plans to complete 2nd section Herring Run Sanitary Sewerage Interceptor, east of Horner's Run and extend from Sinclair Lane 2,900 ft. $70,000.

Nev., Las Vegas—Sewers, disposal plant. Benham Eng. Co., Gumbel Bldg., Kansas City, Mo., engrs.

N. J., Allenwood—Bd. Boro Council, Boro Hall, revised plans 1 story, concrete, steel, sewage disposal plant. $50,000. L. Cubberley, 210 Bway., Long Branch, engr. Noted July 31.

N. J., North Long Branch (Long Branch P. O.)—City, new settling tank, and 1,000 ft. outfall sewer. O. R. Seaman, 442 Dewey St., Long Branch, engr.

See proposal advertising on page 95

Constr. News page 61

LEADITE

Trade Mark Registered U.S. Pat. Office

395,665 feet of c.i. Water Mains

laid with LEADITE Joints

by H. W. Golden and Son, Inc., Troy, N. Y.

The installations tabulated below totaled nearly 75 miles,—pipe varying from 6 in. to 36 in. diameter,—test pressures as high as 200 lbs. per sq. inch. This firm is so pleased with the performance of LEADITE, that they state as follows:

"We will insist on telling other Contractors the success we have had with LEADITE."

Location of Job	Length of of Line (Feet)	Diameter of Pipe (Inches)	Under Supervision of
City of New Britain, Conn.	4,294	12	City Engineer, New Britain, Conn.
Town of Newington, Conn.	6,109	12	Louis A. Oldershaw, Engr., 259 Main St., New Britain, Conn.
" " " "	8,450	10	
" " " "	1,464	8	
" " " "	10,878	6	
City of Norwich, Conn.	5,884	24	Chandler & Palmer, Engrs., Thayer Bldg., Norwich, Conn.
" " " "	21,883	30	
City of Stamford, Conn.	11,272	36	Stamford Water Co., Stamford, Conn.
Village of St. Johnsville	30,062	8	James P. Wells, Engr., Rochester, N. Y.
" " " "	6,700	6	
Town of Somerset, Mass.	25,798	12	F. A. Barbour, Consulting Engineer, Boston, Mass.
" " " "	1,059	6	
Town of Warwick, R. I.	6,167	30	Fay, Spofford & Thorndike, Consulting Engineers, Boston, Mass.
" " " "	2,763	24	
" " " "	5,007	20	
" " " "	9,509	16	
" " " "	37,718	12	
" " " "	24,606	10	
" " " "	42,190	8	
	133,852	6	

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Tested and used for over 30 years.
Saves at least 75%.

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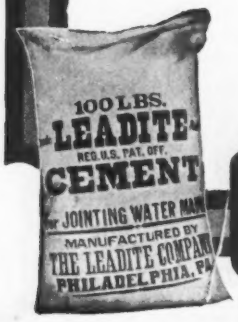
Land Title Building - - - Philadelphia, Pa.



No Caulking

Sewers (Continued)

N. J., South Amboy—Bd. City Council, City Hall, municipal sewage disposal plant. $25,000 or more. Engineer not selected.

N. J., Ventnor (br. Atlantic City) — Joint Bd. City Council, City Hall, joint sewage disposal plant on Shelter Island. $400,000. Project in abeyance. E. R. Rightmire, 530 Guarantee Trust Bldg., Atlantic City, engr. Noted Dec. 4.

N. J., West New York—Joint Bd. Council of West New York and Guttenburg, Municipal Bldg., preliminary plans extending sanitary storm sewers, opening, grading, widening Bway. north of 23rd St. into Guttenberg. $98,000. F. Olieri, 650 Bergenline Ave., engr.

N. Y., Long Beach—City Council, J. J. McCabe, city clk., rejected bids Jan. 13, extending sewage disposal plant. Noted Jan. 1.

O., Delphos — Preliminary plans separate sludge digestion sewage plant. $100,000. Engineer not selected.

O., Wellsville — City retained W. H. Dittoe, consult. engr., Youngstown, to prepare plans new filtration plant. $100,000.

Ont., Brantford—For 2 mi. 8 in. and up, vitr. clay storm sewers in 12 streets. $50,000. F. P. Adams, City Hall, engr.

Ont., Kitchener—For 8,000 ft. 36 in. concrete storm sewer in Edna St. $60,000. S. Shupe, City Hall, engr.

BIDS ASKED

Ill., Chicago—Feb. 26, by J. J. Sullivan, clk. Sanitary Dist. of Chicago, 910 South Michigan Ave., West Side Sewage Treatment Works—Div. BB.; adv. E. N.-R. Feb. 12.

Kan., Topeka—City, bids probably about Feb. 15. 8- to 18-in. sanitary sewers in Oakland St. $90,000. W. E. Baldry, City Hall, engr.

Mich., Muskegon Heights—Mar. 4, by City, for Div. A, sewage-treatment plant. $118,000. Suhr, Berryman, Peterson & Suhr, 134 North Wells St., Chicago, Ill., engrs. Noted Dec. 4.

Neb., Grand Rapids—Mar. 4, by H. E. Clifford, city clk., sewage disposal plant, incl. grit chamber, screen house, preliminary clarifier, aeration tanks, final clarifier sludge beds, pump and boiler house, 15,400 cu.yd. excav., 1,850 cu.yd. rein.-con. $130,000. Black & Veatch, 700 Mutual Bldg., Kansas City, Mo., engrs.

N. J., Long Beach—Feb. 14, by Township Com., Twp. Hall, 792 lin. ft. 12 and 24 in. c.i. pipe, *2,365 lin. ft. 12- to 24-in. terra cotta pipe, manholes, inlets for storm water drain on Long Beach Blvd. or Bay Ave. from 51st St. to Farragut Ave. at Brant Ave. $25,000. Sherman & Sleeper, 501 Cooper St., Camden, engrs.

Tex., Austin — Feb. 18, by City, c/o A. R. Johnson, Austin, 6,785 ft. precast concrete or monolithic storm sewers in East Ave., East 3rd and Waller Sts., $40,000; 6,019 ft. precast concrete or monolithic storm sewers and 1,000 sq. yd. brick on concrete pavement, East 6th and West Lynn Sts., $30,000; 2,586 ft. monolithic concrete or precast concrete sewers in Barton Springs Rd. and channel change in Bouldin Creek Cut-off, incl. 19,500 cu.yd. earth and 6,300 cu. yd. rock excav., $35,000. C. G. Levander, bridge and drainage engr.

Ont., Hamilton—See "Contracts Awarded."

CONTRACTS AWARDED

La., Donaldsonville—S. A. Marchand, mayor, complete sanitary sewerage system, to J. B. McCrary Co., Citizens & Southern Bldg., Atlanta, Ga., $113,240. Noted Jan. 1.

Mass., Boston—City, Dpt. P. Wks., sewerage works, Morton St., Dorchester, to C. Struzziery, 115 Kittredge St., Roslindale, $31,167.

Mich, Flint—City Clerk (2d and final unit), sewage treatment plant, Contr. SD6, incl. aeration tank, blower building, trickling filters, final settling tanks and chlorination building, piping, drainage, to W. E. Wood Co., Union Trust Bldg., Detroit, $479,000. Noted Jan. 1.

Mo., Kansas City—Sanitary and storm sewers, 4th extension, to Torson Constr. Co., 46th St. and Gilham Rd., $62,308 est. $87,000; 8 ft. rein.-con. sewer in Gilham Rd. between 39th and 43rd Sts., to Boyle Constr. Co., 226 West 39th St., $104,978. Noted Dec. 11.

N. Y., Far Rockaway—Commissioners West Long Beach Sewer Dist., Nassau Co., sewers in West Long Beach Sewer Dist., to A. Paino Constr. Co., 16 Water St., Brooklyn, $91,929. Noted Dec. 18.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., to A. Capasso, 865 Liberty Ave., Brooklyn, sewers in Winchester Blvd. $18,607, 85th St. $1,141, 148th St. $1,414; to M. Fornaro, 1730 70th St., Brooklyn, 94th Ave. $1,542; to Marmoth Constr. Co., 94-14 108th Ave., Jamaica, 119th Rd., 88,876, Jamaica Ave. $7,106; to A. Maio, 123-07 116th Ave., Brooklyn, 197th St., $582; to Catapano & Ambrosio, 8211 Bay Parkway, Brooklyn, 183rd St., $73,554. Grand total $112,822. Noted Jan. 15.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewer in Jamaica Ave., to A. Clemente, 1193 Spofford Ave., New York, $12,781. Noted Nov. 20.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewers in Jansen Ave., to Logran Contg. Co., 2301 Beverly Rd., Brooklyn, $22,242; Metropolitan Ave., to L. Piali, 199 East Ave., $14,213; Queens Blvd., to P. Tomasetti, 1974 60th St., Brooklyn, $66,287; Yellowstone Ave., to Picone Contg. Co., 102-09 217th St., Hollis, $60,368; 36th St., to Pan Constr. Co., 244 Jackson Ave., $12,004; 211th St., to Matarazzo & Yondola, 1163 61st St., Brooklyn, $7,383. Grand total $182,497. Noted Jan. 22.

N. Y., New York—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., sewers in Cheseborough Ave., to P. Tedesco, 1435 Williamsbridge Rd., $1,458; East 221st St., to A. Spadaro, 724 East 225th St., $5,005—Tenbroeck Ave., to Caserta Constr. Co., 2442 Barnes Ave., $895. Grand total $7,358. Noted Jan. 30 Daily.

N. Y., Utica—City, Whitesboro Street Intercepter Sanitary Sewer, to Cittadino & Virgillion, Utica, $110,214.

Okla., Kingfisher—M. Crostwait, city clk., new sewage disposal plant, to Asplund Constr. Co., Enid, $20,785. Est. $25,000. Noted Dec. 11.

Ont., Hamilton—Sewers in Main St. from Bay to MacNab Sts., incl. 8 in. up vitr. tile pipe, day labor. $25,000. W. L. McFaul, City Hall, engr.

WASTE DISPOSAL

PROPOSED WORK

N. J., South Amboy—Bd. City Council, City Hall, municipal garage incinerator. $25,000. **Maturity probably soon.** Engineer not selected.

CONTRACTS AWARDED

Que., Montreal—City Council, 2 story, 151 x 163 ft., steel, brick incinerator in St. Anne ward section, to St. George-Carthage Constr. Co., Ltd., 4820 4th Ave., Rsmt., Montreal, $194,980; supplying, installing equipment, to Bartlett Snow Company of Canada. Total est. $500,000.

BRIDGES

PROPOSED WORK

Fla., Clearwater—Bd. Comrs. Pinellas Co., soon lets contract for work in connection with protection of John's Pass Bridge from erosion and scouring action of tiles, incl. construction of seaward groyne, rip-raps, additional piling for bridge footings, at Long and Sand Keys, near Madera Beach. C. E. Burleson, co. engr.

Ill., Chicago—Bd. P. Wks., new bridge replacing old lift bridge, at South Halsted St. $2,700,000. R. W. Wolfe, comr. Noted Nov. 20.

Ill., Chicago—City, at office Bd. P. Wks., soon takes bids bridge over Chicago River, at State St. $3,500,000. R. W. Wolfe, comr. Noted Nov. 20.

Indiana and Kentucky — Louisville & Nashville R.R. Co., 10th St. and Bway., Louisville, Ky., W. H. Courtenay, ch. engr., new bridge over Ohio River from Evansville, Ind., to Henderson, Ky. $5,000,000.

Minn., Granite Falls — State Hy. Dpt., St. Paul, three 120 ft. rein.-con. span bridge over Minnesota River, Yellow Medicine Co.

Massachusetts — Commonwealth of Massachusetts, Dpt. P. Wks., State House, Boston, rein.-con., steel bridge over Connecticut River between Erving and Gill. A. W. Dean, c/o Dpt. P. Wks., engr.

New Jersey—Joint Bd. Comrs. of Asbury Park and Ocean Grove, City Hall, Asbury Park, 2 steel, timber, concrete bridges across Wesley Lake at Emory St. and at Heck Ave. $40,000. Address City Engineer of Asbury Park.

N. J., Point Pleasant—Bd. Freeholders Ocean Co., Court House, steel, timber bridge with swing draw over Beaver Dam, connecting Point Pleasant with Metedeconk. (Swing draw will be used that is now in use on Mantoloking Bridge.) $25,000 or more. H. C. Shinn, Municipal Bldg., Lakewood, co. engr. Noted Dec. 4.

O., Struthers—Mahoning Co., (Youngstown) new concrete, steel bridge, 22 ft. wide, 4 ft. wider than present structure, on North Side. $50,000.

Okla., Oklahoma City—City Council, preliminary plans 6 span, 900 ft. steel truss bridge on concrete piers, at Penn St. $175,000. G. B. Brown, City Hall, engr.

Texas — State Hy. Comn., W. R. Ely, chn., Austin **(F.A.P. means Federal Aid Project)**, rein.-con. bridges on Hy. 6, F.A.P. 471, Brazos Co., $80,000—steel, con ete bridges over Buck Creek and Prairie Dog Town Fork of Red River Hy. 4, F.A.P. 573-B, $80,000—steel, concrete bridge over Neches River, State Aid Project 606-A, Jasper and Tyler Counties, $160,000.

Texas—State Hy. Com., W. R. Ely, chn., Austin, 1,040 ft. steel, and concrete bridges on Hy. 43, Federal Aid project 582-C., Robertson Co., $50,000; 1,020 ft. rein.-con. bridge over Leon River on Hy. 10, Federal Aid Project 580-A, Comanche Co. $90,000. G. G. Wickline, Austin, bridge engr.

Tex., Fort Worth—Tarrant Co., c/o W. E. Yancey, aud., Fort Worth, 3 span 195 ft. concrete, steel girder bridge over Trinity River on Albright Rd. D. A. Davis, Fort Worth, engr.

Wash., Chehalis — Bd. Comrs. Lewis Co., 2 timber bridges over Upper Lewis River, one Rock Creek Bridge, 220 ft. long, 135 ft. above river, other Jim Creek Bridge, 230 ft. long, $31,000. R. L. Greene, Chehalis, engr.

Wash., Seattle—City Council, Albro Pl. bridge approaches, grading, paving Swift Ave. and Swift Avenue extension. $230,000. R. H. Thomson, Seattle, engr. City and railroads share in cost.

BIDS ASKED

California — Feb. 18, by State Hy. Comn., Sacramento, timber bridge over Mark West Creek 4.5 mi. north of Santa Rosa, Sonoma Co., incl. six 19 ft. and two 16 ft. 10 in. spans, surfaced with concrete on pile bents, grading, concrete paving approaches; removing trees, removing, resetting headwalls, fences, grading, drainage structures, concrete surfacing 7.7 mi. Houston School Rd., San Joaquin Co. C. H. Purcell, hy. engr.

Georgia—Feb. 17, by J. W. Barnett, engr., east point, concrete slab bridge on Tifton-Sylvester Rd., State Aid Project 209, Tift Co.; concrete slab bridge on Covington-Madison Rd., Federal Aid Project 153-D, Newton Co., for State Hy. Dpt., East Point.

Iowa—Feb. 17, at office C. R. Jones, aud., State Hy. Comn., Ames, bridges, culverts in Black Hawk Butler, Clayton, Decatur, Plymouth, Tama and Woodbury Counties.

Michigan—Feb. 19, at office of R. A. Beers, resident engr., Kalamazoo, MBr. 1 of 80-14-2, Contrs. 2 and 3, 2 rein.-con. abutments, steel deck girder, Van Buren Co., for State Hy. Dept., Lansing.

Michigan—See "Streets and Roads."

New Jersey—Mar. 2, by State Hy. Comn., Trenton, bridge, approaches over Delaware, Lackawanna & Western R.R., on Route 31, Sect. 3, Morris Co. A. L. Grover, ch. engr.; adv. E. N.-R. Feb. 12.

N. J., Jersey City — Mar. 2, by State Hy. Comn., Trenton, furnishing, erecting structural steel, for hy. viaduct on Route 25, Connecting Link, Sect. 2, Contr. 42, Hudson Co. A. L. Grover, ch. clk.; adv. E. N.-R. Feb. 12.

Ohio—Feb. 24, by O. W. Merrell, dir. hys., Columbus, 110 ft. span, concrete arch bridge, approaches 31 ft. roadway, two 5 ft. sid walks, on Sect. "B" Medina-Elyria Rd., Lorain Co., $49,936—130 ft. span concrete arch bridge, approach 20 ft. roadway, Sect. "P" Milan-Elyria Rd., Erie Co., $60,201—five 70 ft. span steel beam bridge, 30 ft. roadway, over Blanchard River, Sect. "K" Findlay-Upper Sandusky Rd., Hancock Co., $94,936—three 28-3 ft. span, concrete slab bridge, approaches, 24 ft. roadway, Sect. "S" Defiance-Delphos Rd., Van Wert Co., $12,983—60 ft. span concrete beam bridge, 30 ft. roadway, Sect. "I" Lima-Sandusky Rd., Sandusky Co., $14,525—40 ft. span concrete beam bridge, 24 ft. roadway, Sect. "E" Upper Sandusky-Tiffin Rd., Wyandot Co., $22,986.

Tennessee—Feb. 27, by State Dpt. Hys. & P. Wks., Nashville, Special Bridge Project 18, incl. concrete, steel bridge over Tennessee River between Dayton and Decatur, Rhea and Meigs Counties. R. H. Baker, hy. comr.

Tennessee—See "Streets and Roads."

Tex., Austin—Feb. 18, by City, c/o A. R. Johnson, mgr., 3 rein.-con. bridges, 2 over Waller Creek and 1 over Blum Creek, $26,000; 2 rein.-con. bridges over West Waller Creek and Bouldin Creek on Bacton Springs Rd., $25,000, C. G. Levander, Austin, bridge engr.

Vermont—Feb. 13, by State Hy. Dpt., Montpelier, 28 ft. T-beam bridge, gravel approaches, Williamstown; 3 span, concrete bridge, gravel approaches, Lester.

Virginia—Feb. 24, by State Hy. Dpt., Richmond, 127 ft. bridge over Po River, on Route 51, 13 mi. from Fredericksburg, Spotsylvania Co.; 279 ft. bridge over Nansemond River, Route 10, at Reids Ferry, also gravel surfacing 7.4 mi. roadway beginning at Buena Vista, Rockbridge Co. W. C. Thomas, assistant engr.

CONTRACTS AWARDED

Indiana — State Hy. Comn., Indianapolis, 2 rein.-con., steel bridges in Johnson Co., to A. G. Ryan Constr. Co., Chrisney, $20,824 est. $27,602; rein.-con., steel bridge in Porter Co., to H. Tharp, Fountain City, $42,521 est. $53,429. Noted Jan. 15.

Iowa—State Hy. Comn., Ames, 25 x 12 x 78 ft. rein.-con. arch bridge in Van Buren Co., to G. Jordan, Centerville, $6,986—90 x 20 ft. pony truss bridge with two 40 x 20 ft. I-beam approach spans, Van Buren Co., to Lundgren-Reis Co., 125 College St., Des Moines, $15,779—120 x 20 ft. high truss bridge with two 40 x 20 ft. I-beam approach spans, Warren Co., and 41 culverts, extensions Shelby Co., to Wickham Bridge Co., 1905 West Bway., Council Bluffs, $21,200 and $7,000 respectively—8 box culverts, Van Buren Co., to W. Denny, West Liberty, $2,660. Grand total $53,625.

Me., Wells—State Hy. Dpt., Augusta, concrete bridges in Buffam and Capell, to Cook & Co., Inc., 133 Sherman St., Portland, $14,308 and $4,793 respectively—bridge in Donnells to Luten Bridge Co., Clarksburg, W. Va., $9,517. Grand total $28,618. Noted Jan. 29.

Pa., Pittsburgh—Bd. Comrs. Allegheny Co., Court House, removing, disposing of old bridge, erecting new steel, concrete bridge at Flaghertys Run, Moon Twp., incl. 4,100 cu.yd. excav., 675 cu.yd. concrete, 69,000 lb. reinforcing steel, curbing, sidewalks, 230 sq.yd. concrete surfacing, to Union Eng. & Constr. Co., Fitzsimmons Bldg., $21,650. Noted Jan. 22.

Constr. News page 62

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34A

STREETS AND ROADS

BIDS ASKED

California — Feb. 25, by State Hy. Comn., Sacramento, clearing, grubbing, right-of-way, grading, drainage structures 0.7 mi. Paxton-Keddie Rd., Plumas Co. C. H. Purcell, hy. engr.

California—See "Bridges."

D. C., Wash.—Feb. 16, by District Comrs., District Bldg., improving streets, incl. 68,500 cu.yd. cement paving, 10,000 cu.yd. guttering, 64,000 cu.yd. asphalt paving.

D. C., Wash.—Feb. 17, by District Comrs., District Bldg., concrete paving 45,000 sq.yd.

Georgia—Feb. 17 by J. W. Barnett, engr., East Point, **(F.A.P. means Federal Aid Project)**, grading, 3 bridges on 5.5 mi. Thomasville-Cario Rd., F.A.P. 474-A, Thomas Co.—grading, 1 bridge on 11.4 mi. Madison-Watkinsville Rd., F.A.P. 444-A, Oconee and Morgan Counties—concrete paving 8.9 mi. Cornelia-Toccoa Rd., F.A.P. 469, Habersham Co.—9.7 mi. Statesboro-Savannah Rd., F.A.P. 197 A and B and 229, Bullock Co. — 8.2 mi. Marietta-Canton Rd., F.A.P. 464, Cobb Co.—sand clay surfacing 11 mi. Jesup-Ludourci Rd., State Aid Project 907 and 907E, Wayne and Long Counties, for State Hy. Dpt., East Point.

Indiana — Feb. 24, by State Hy. Comn., Indianapolis **(F.A.P. means Federal Aid Project)**, concrete, bituminous concrete or brick surfacing 5.843 mi. Vincennes-Washington Rd., State Rd. 50, F.A.P. 114-B, Knox and Daviess Counties—5.302 mi. Petersburg-Vincennes Rd., State Rd. 24, F.A.P. 121, Pike and Knox Counties—7.453 mi. Wolcott-Monticello Rd., State Rd. 24, F.A.P. 144-B, and 7.805 mi. same road, Sect. G, White Co.—7.083 mi. North Vernon-Columbus Rd., State Rd. 7, F.A.P 163-A, Jennings Co—7.362 mi. North Vernon-Columbus Rd., State Rd. 7, F.A.P. 163-B, Jennings and Bartholomew Counties—11.567 mi. Indianapolis-Logansport Rd., State Rd. 29, F.A.P. 221-A, Hamilton and Boone Counties — 13.162 mi. Indianapolis-Logansport Rd., State Rd. 29, F.A.P. 221-B, Boone and Clinton Counties — grading, drainage structures, bridges, 20 ft. clear span or under 4.113 mi. Madison-Blocher Rd., State Rd. 56, F.A.P. 212-A, Scott and Jefferson Counties—4.015 mi. Madison-Blocher Rd., State Rd. 56, F.A.P. 212-B, 1.622 mi. Madison-Blocher Rd., State Rd. 56, F.A.P. 212-C, both Jefferson Co. J. J. Brown, dir. State furnishes cement.

Ind., Boonville—Mar. 2, by Bd. Comrs. Warrick Co., grading, drainage structures, paving Henry W. Metzger Rd., et al., Boon Twp. $38,776. E. Bracher, co. aud.

Iowa—Feb. 17, at office C. R. Jones, aud., State Hy. Comn., Ames, grading, drainage structures paving roads in Black Hawk, Clayton, Crawford, Fremont, Marshall, and Tama Counties.

Ia., Independence—Feb. 16, at office Auditor Buchanan Co., gravel surfacing 18.25 mi. secondary roads, incl. 10,950 cu.yd. gravel, 78,000 units overhaul, also 3 carloads standard sawed fir bridge plank, 3 carloads standard sawed creosoted fir, 5,500 ft. corrugated culverts, 80,000 gal. gasoline.

Kansas—Feb. 16, by State Hy. Comn., Topeka, grading, culverts 7.444 mi. K1, Federal Aid Project 286-C, Ellis Co.; 17.262 mi. U. S. 40N., Federal Aid Project 370-E, Rooks Co., both 30 ft. wide. W. V. Buck, hy. engr.

Kansas — Feb. 18, by State Hy. Comn., at Court House, Salina, concrete surfacing 2.031 mi. U. S. Hy. 81, Federal Aid Project 287-A and 2.981 mi. same road, Sect. B, 20 ft., McPherson Co. W. V. Buck, Topeka, engr.

Kentucky—Mar. 11, by State Hy. Dpt., Frankfort, grading drainage structure 8.939 mi. Albany-Burkesville Rd., Clinton Co.—8.183 mi. Frankfort-Lawrenceburg Rd., Franklin and Anderson Counties—10.611 mi. Russellville-Guthrie Rd., Todd Co.—grading, drainage structures, surfacing bridge approaches 0.321 mi. Louisville-Shelbyville Rd., Jefferson Co., incl. three 34 ft. span rein.-con. deck girder bridge over Long Run Creek—0.191 mi. Whitesburg-Hazard Rd., incl. two 26 ft. span rein.-con. deck girder bridge over Marlowe Creek; 0.138 mi. Whitesburg-Jenkins Rd., incl. one 40 ft. span rein.-con. deck girder bridge over Ermine River, both Letcher Co.—surfacing 7.747 mi. Marion-Fords Ferry Rd.—9.206 mi. Louisville-Paducah Rd., both Crittenden Co.—10.641 mi. Brownsville-Leitchfield Rd., Edmonson Co.—10.764 mi. Prestonburg-Pikeville Rd., Floyd Co.—8.69 mi. Louisville-Paducah Rd., Hancock and Breckenridge Counties—4.079 mi. Jenkins-Pikeville Rd., Letcher Co.—11.068 mi. Bedford-Carrollton Rd., Trimble and Carroll Counties—9.27 mi. Louisville-Paducah Rd., Union Co.—7.5 mi. Warsaw-Carrollton Rd., Gallatin Co.—11.748 mi. Henderson-Madisonville Rd., Webster Co. B. Johnson, chn.

La., Lafayette—Feb. 16, by Bd. City Trustees grading, drainage structures concrete or brick widening 14,000 sq.yd., concrete, asphaltic concrete or brick paving 42,000 sq.yd. L. J. Voorhies, Baton Rouge, engr.

Maryland—Feb. 17, by State Roads Comn., Baltimore, G. C. Uhl, chn., concrete paving 2.13 mi. Contr. AA-112-72, Federal Aid Project 229, Anne Arundel Co.—1.73 mi. Contr. Cl-94-54, Federal Aid Project 209B, Carroll Co.—penetration macadam paving 1.07 mi. Contr. P-154-32, Prince George's Co.; adv. E. N.-R. Feb. 12.

Md., Baltimore—Feb. 18, by Bd. Awards, sheet asphalt paving 6,650 sq.yd. streets listed in Contr. .579; concrete paving 7,550 sq.yd. streets listed in Contr. 580. N. L. Smith, Municipal Bldg., hys. engr.

Michigan—Feb. 17, by J. T. Sharpensteen, div. engr., Escanaba, grading, shaping, drainage structures 12.684 mi. FO17-33, Contr. 1, Chippewa Co., for State Hy. Comn., Lansing.

Michigan—Feb. 17, by J. T. Sharpensteen, div. bridge engr., Escanaba, grading, shaping, drainage structures, 2 course gravel surfacing 4.955 mi. FO66-21-Contr. 1.18 ft., Ontonagon Co., for State Hy. Comn., Lansing, G. C. Dillman, hy. comr.

Michigan—Feb. 17, by J. T. Sharpensteen, div. engr., Escanaba, grading, drainage structures, concrete paving 3.454 mi. FO55-18, Contr. 1.20 ft., Menominee Co., for State Hy. Comn., Lansing.

Michigan—Feb. 18, by A. L. Burridge, Cadillac, div. bridge engr., grading, shaping, drainage structures 6.581 mi. FO10-6, Contr. 2, Benzie Co., for State Hy. Comn., Lansing. G. C. Dillman, hy. comr.

Michigan—Feb. 19, by R. A. Beers, resident engr., Kalamazoo, grading, shaping, drainage structures, concrete paving 4.942 mi. FO78-11C-3, and F.A.Br. 1 of 78-8-4C-1 and 2, 2 rein.-con. abutments, steel deck girder bridge, concrete flooring, St. Joseph Co., for State Hy. Comn., Lansing.

Nevada—Feb. 18, by State Hy. Dpt., Carson City, grading culverts, graveling 35,200 cu.yd. D-1 Las Vegas to Boulder Dam, Clark Co. S. C. Durkee, state engr.

New Jersey—Mar. 2, by State Hy. Comn., Trenton, 9 in. single line rein.-con. paving 7.43 mi. Route 39, Sect. 2, Kings Highway to Mount Laurel-Hainesport Rd., and 7.803 mi. Route 40, Sect. 5, Red Lion to Buddtown-Fourt Mile Rd., Burlington Co. A. L. Grover, ch. clk.; adv. E. N.-R. Feb. 12.

N. J., Jersey City — Port of New York Authority .80-90 8th Ave., New York, rejected bids Nov. 10, maintenance of New Jersey Plaza of Holland Tunnel, during ensuing year. Noted Nov. 20.

New York—Feb. 27, by A. W. Brandt, comr. Hy., Albany, constructing hys. in Dutchess, Monroe and Rensselaer Counties; reconstructing hys. in Albany, Cortland, Genesee, Nassau, Oneida, Orange, Steuben and Livingston Counties —also Mar. 3, construcing hys. in Erie, Dutchess, Oneida and Madison and Washington Counties; reconstructing hys. in Cayuga and Onondaga, Cortland, Oneida, Oswego, Washington, and Westchester Counties, adv. E. N.-R. Feb. 12.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., bids latter part March, borings for elevated hy. along Hudson River from 22nd to 42nd Sts.; also plans section from 42nd to 59th Sts. **Maturity in fall.**

Ohio—Feb. 24, by O. W. Merrell, hy. dir., Columbus, 4-in. brick on 7 in. concrete paving 0.129 mi. Sect. "J" Cleveland-Buffalo Rd., Lake Co., $20,857—concrete paving 1.018 mi. Sect. "E-3" Coshocton-Millersburg Rd., Holmes Co., $39,771—2.118 mi. Sect. "G" same road $129,-ft. wide) $129,887—3.886 mi. Sect. "D" Cleve-Cleveland-East Liverpool Rd., Columbiana Co., $160,297—2.196 mi. Sect. "B" Defiance-Ft. Wayne Rd., Defiance Co., $48,133, all foregoing 20 ft. wide—1.893 mi. Sect. "D-1" Toledo-Angola Rd., Williams Co., 30 ft., $63,882—waterbound macadam paving 0.362 mi. Sect. "P" Milan-Elyria Rd., Erie Co., 20 ft., $33,604—concrete or sheet asphalt paving 3.516 mi. Sect. "O" Cleveland-Buffalo Rd., Ashtabula Co., 40 ft., $267,376 or $279,837 respectively—waterbound macadam or bituminous macadam paving 3.867 mi. Sect. "P" Cincinnati-Zanesville Rd., Clinton Co., $127,989 or $105,045 respectively—brick or concrete paving 1.707 mi. Sect. "Q" Zanesville-Caldwell Rd., Guernsey Co., $79,946 or $54,701, respectively, brick or concrete paving 8.006 mi. Sect. "O" and "P" Zanesville-Caldwell Rd., Muskingum Co., $381,591 or $288,855 respectively, all foregoing 20 ft. wide—driving steel piling, rein.-con. filling 810 ft. Sect. "A" Ohio River Rd., Hamilton Co., 40 ft., $23,767 —straightening creek and gravel construction 1.429 mi. Sect. "Q" West Union-Portsmouth Rd., Scioto Co., 20 ft., $44,101.

O., Miles Heights (br. Cleveland)—Feb. 16, by Village, sheet asphalt, concrete or asphaltic concrete paving 4 streets. $50,000. Lander Eng. Co., Engineers Bldg., Cleveland, engrs.

Pa., Phila.—Feb. 17, by Bureau of P. Hys., A. Murdock, dir. P. Wks., curbing and footway work in Hy. Dists. 1, 2, 3, 5 and 7, 6, Schedule "A" (city to pay); curbing and footway work in Hy. Dists. 1, 2, 3, 5 and 7, 6, Schedule "B" (property owner to pay).

Tennessee—Feb. 27, by State Dpt. Hys. & P. Wks., Nashville **(F.A.P. means Federal Aid Project)**, paving 7.905 mi. Humphreys Co. Line-Dickson Rd., State Hy. 1, F.A.P. 220-B (re-opened), Dickson Co.—5.265 mi. McEwen-Dickson Co. Line Rd., State Hy. 1, F.A.P. 220-A Humphreys Co.—11.58 mi Tiptonville-Dyer Co. Line Rd., State Hy. 78, F.A.P. 253-A, Lake and Obion Counties—8.87 mi. Clear Creek-Spring City Rd., State Hy. 29, F.A.P. 231-F, Rhea Co., also 5 bridges over 20 ft. span, let separately—grading, drainage structures 5.517 mi. Jonesboro-Johnson City Rd., State Hy. 34, F.A.P. 6 (re-opened), Washington Co. R. H. Baker, hy. comr.

Texas—Feb. 27, by G. Gilchrist, state hy. engr., Austin, double bituminous surfacing 12 mi. Hy. 40, Job M-10-L-5, $25,000—12 mi. Hy. 21, Job M-10-I-5, $26,000, both Cherokee Co.—16 mi. Hy. 11, Job M-1-C-5, Hopkins Co. $34,000 — 10.203 mi. Hy. 37 Job M-10-H-5, Wood Co. $25,000—single bituminous surface treating 60.558 mi. Hy. 130, Jobs M-6-F-3 and M-6-F-3, Culberson and Hudspeth Counties, $130,000, all foregoing 18 ft. wide.

Tex., Big Spring—Feb. 17, by City, c/o J. R. Smithan, mgr., grading, concrete curbing and guttering, 1½ in. hot mix limestone rock asphalt on 6 in. stone, 6 in. rein.-con., or 1½ in. cold rolled limestone rock asphalt on 5 in. plain concrete paving 31,200 sq.yd.

Tex., Corsicana—Feb. 17, by City, c/o J. P. Welch, secy., grading, curbing, guttering, vertical fibre brick, asphaltic concrete, Uvalde rock asphalt, limestone rock asphalt, warrenite bitulithic, concrete or asphalt macadam paving 36,915 sq.yd.

Wash., Seattle—King Co. bids about Mar. 21, grading, bridging, paving 1 mi. Arilha Rd., $28,700; paving 1.5 mi. Algona Rd. $25,000. T. D. Hunt, Seattle, co. engr.

Wisconsin—Feb. 18, by State and Polk, Rusk, Sawyer, Bayfield, Burnett and Douglas Counties Hy. Comns., Telegram Bldg., Superior, grading, graveling, 16.95 mi. St. Croix Falls-Grantsburg Rd., S. T. H. 87, S. A. P. 8386, Polk Co.—9.5 mi. Prentice-Ladysmith Rd., U. S. Hy. 8, F. A. P. 371-E—0.5 mi. Ingram Relocation, S. T. H. 73, S. A. P. 8439, both Rusk Co.—3.06 mi. Ashland-Bayfield Rd., S. T. H. 13, S. A. P. 8389, Bayfield Co.—8.31 mi. Siren-Spooner Rd., S. T. H. 70, S. A. P. 8398, Burnett Co—5.4 mi. Radisson-Winter Rd., S. T. H. 70, S. A. P. 8417, Sawyer Co.—4.6 mi. St. Croix Falls-Grantsburg Rd., S. T. H. 87, S. A. P. 8385, Burnett Co.—3.87 mi. Hayward-Glidden Rd., S. T. H. 77, S. A. P. 8396, Sawyer Co.—grading 1.42 mi. Spooner-Superior Rd., U. S. Hy. 53, S. A. P. 8310, Douglas Co.—1.88 mi. Ashland-Hayward-Trego Rd. S. T. H. 24, S. A. P. 8412, Bayfield Co.

CONTRACTS AWARDED

Arizona—State Hy. Comn., Phoenix, oil processing 15.5 mi. Florence-Tucson Hy., F.A.P. 94-F, to Imperial Trucking Corp., 1900 Central St., Kansas City, Mo., $64,146. Noted Jan. 22.

California—State Hy. Comn., Sacramento, grading, asphaltic concrete surfacing 6.3 mi. San Bernardino-El Centro Rd., between Trifolium Canal and Kane Springs, Imperial Co., to Griffith Co., Los Angeles Railway Bldg., Los Angeles, $142,323. Noted Jan. 8.

Connecticut—State Hy. Dpt., J. A. Macdonald, comr., Hartford, rein.-con. paving 30,884 ft., Chaplin and Eastford, to L. Suzio Constr. Co., Meriden, $205,170 — 6,835 ft., Rockville and Manchester, to M. A. Gammino Constr. Co., 728 Valley St., Providence, R. I., $35,780—31,600 ft., New Milford and Washington, and grading, native gravel surfacing 9,362 ft., Washington, to Osborn-Barnes Co., Main St., Danbury, $218,799 and $60,408 respectively—rein.-con. paving 17,795 ft. Stamford, to P. Bacco, 33 Bank St., Stamford, $135,187 — traprock waterbound macadam paving 1,200 ft. Sharon, to Chas. Smith & Sons, Inc., 101 Water St., Derby, $7,994—bituminous macadam paving 7,490 ft., East Windsor, to D. Massilli, Bloomfield, $34,035—grading, drainage structures 14,505 ft. Milford, and grading, native gravel surfacing 5,500 ft., Washington and Litchfield, to Arborio Road Constr. Co., 408 Main St., Hartford, $109,437 and $112,000 respectively — rein.-con. bridge, approaches on Torrington-Litchfield Rd., Washington and Litchfield, to John DeMichiel & Bro., Torrington, $21,814—concrete encased plate girder bridge, approaches over Quinnebaug River, on North Woodstock-Quinnebaug Rd., Thompson, to J. McCormick, 315 Taunton Ave., East Providence, R. I., $38,569. Grand total $979,193. Noted Jan. 1.

Ill., Westmont—City Council, concrete paving 12,600 sq.yd., to E. D. Otto, Downers Grove, $42,241.

Iowa—State Hy. Comn., Ames, grading, drainage structures 4.406 mi. roads in Fremont Co., to E. J. Wilson & Son, Omaha, Neb., $62,855—11.54 mi. Iowa Co., to J. W. Ross, Newton, $75,591—5.856 mi. Pottawattamie Co., to J. A. Carlson Constr. Co., Omaha, Neb. $39,510—2.359 mi. Van Buren Co., to J. H. Miller & Son, Leon, $32,846—gravel surfacing 6.3 mi. Lucas Co., to W. T. Kelley, Des Moines, $6,912 — 11.679 mi. Mills Co., and 6 mi. Muscatine Co., to McDougall Constr. Co., Sioux City, $26,658 and $8,225 respectively—rip rap in Howard Co., to A. L. Albrecht, Storm Lake, $810—guard rail in various counties, Dist. 9, to Craig Constr. Co., 1341 41st St., Des Moines, $76,329. Grand total $329,736.

Maryland — State Roads Comn., Baltimore, concrete paving 1.15 mi. state hy. along Sudlersville-Delaware Line Rd. from end Contr. Q-58 to Delaware Line, Contr. Q-69-24, Queen Anne Co., and 1.07 mi. state hy. along Goldsboro-Delaware Line Rd. from end of Contr. No. Co-57 at Sandy Island Bridge to Delaware Line, Contr. Co-63-22, Caroline Co., to P. D. Phillips & Bro., Salisbury, $18,515 and $14,495 respectively. Noted Jan. 22.

Md., Baltimore—Bd. Awards, sheet asphalt paving 9,600 sq.yd. streets listed in Contr. 573, to National Paving & Contg. Co., Nelo Dr. and Western Maryland R.R., $41,623; concrete paving 8,700 sq.yd. streets listed in Contr. 574, to P. E. Rawlings, 2400 Aisquith St., $18,018. Noted Jan. 22.

Constr. News page 63

Streets and Roads (Continued)

Mich., Bay City—Bay Co. Road Comn., grading, drainage structures, concrete paving 2 mi. Young Rd., 20 ft. to A. J. Rehmus, Bay City, $36,641.

Mo., Clayton—St. Louis Co., rein.-con. paving 5,760 ft. New Hall's Ferry Rd., to Crean & Scott Constr. Co., 1242 Sublette Ave., St. Louis, $38,239—bituminous concrete surfacing 14,083 lin. ft. Charbonier Rd. and 2,885 ft. Carrico Rd., to Bangert Bros. Constr. Co., G. Ferguson $125,897 and $15,216, respectively. Grand total $179,352.

Neb., Lincoln—T. H. Berg, city clk., grading, curbing, guttering, sheet asphalt paving 6,310 sq.yd. Dist. 810, to Abel Constr. Co., 308-11 Terminal Lincoln, $22,317. Est. 25,000. Noted Jan. 15.

N. Y., Long Island City—G. U. Harvey, pres. Queens Subway Bldg., grading Stanhope St., to Brugel Contg. Co., 1154 Cypress Ave., Ridgewood, $7,270—Elkhorn St., to C. Bennett Impvt. Co., 465 Fenimore St., Brooklyn, $53,405—Fosdick Ave., to Pomonok Asphalt Paving Co., 1246 Grand St., Brooklyn, $2,927—63rd St., to Cleveland Trinidad Paving Co., Flushing, $2,982—64th Lane, to Kennedy & Smith, Bradford Ave., Flushing, $2,277—91st St. and Ralph Ave., to Carbloc Paving Co., Stagg St., Brooklyn, $18,278 and $6,283 respectively—Winifred St. to Palmo Constr. Corp., Woodhaven Blvd., Ozone Park, $6,324. Grand total $99,746. Rejected bids Jan. 26 grading 32nd Ave. and 60th St. Noted Jan. 22.

N. Y., New York—Manhattan Boro and New York Central R.R. Co., F. B. Freeman, ch. engr., 466 Lexington Ave., superstructure elevated hy. along Hudson River from 59th to 72nd Sts., to James Stewart, 230 Park Ave. Approved Jan. 16. Foundations, to Senior & Palmer, 50 Church St., 60% completed. Noted Apr. 17.

N. Y., New York—J. Miller, pres. Manhattan Boro, Municipal Bldg., asphalt paving West 92nd St. and granite block paving Rose St., to Meehan Paving & Constr. Co., 90 West St., $32,316 and $14,794 respectively; altering sewer in Pine St., to J. V. Timoney Constr. Co., 256 Bway., $8,244. Grand total $55,354. Noted Jan. 8.

N. Y., New York—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., grading Watson Ave., to F. Del Balso & Son, 1933 West Farms Rd., $18,204—Fish Ave., to T. DiRoma, 33 Evelyn Pl., $27,884—Eastern Blvd., to F. Mascali & Son, 645 East Tremont Ave., $11,884—East 236th St., to P. Mascali, 645 East Tremont Ave., $1,427—Oakley St., to Gramaglia Bros., 5037 Fieldstone Rd., $9,946. Grand total $69,345. Noted Jan. 30.

O., Cincinnati—C. A. Dykstra, city mgr., City Hall, grading, concrete curbing, guttering, cement sidewalks, concrete paving 4,444 sq.yd. Tappan Ave. from Hoffner St. to South Terminus, to Ace Constr. Co., 2744 Massachusetts Ave., $22,904. Est. $27,839.

O., Columbus—W. H. Duffy, dir. P. Serv., grading, curbing, asphalt paving 15,900 sq.yd. Garden Rd., and grading, 4 in. sub-drain, curbing, asphalt paving 5,700 sq.yd. Calumet St., to B. F. Patterson, 999 West Goodale St., $53,313 and $13,625, respectively. Noted Jan. 15.

Okla., Oklahoma City—M. Peshek, city clk., widening, sheet asphalt resurfacing 9 blocks Robinson St. from Belt R.R. to 20th St., 22 ft., to Western Paving Co., Petroleum Bldg., $35,813. Est. $38,000. Noted Jan. 1.

Okla., Tulsa—Grading, paving 4 blocks Delaware St. from 17th to 21st Sts., to H. L. Cannady & Co., 1122 South Lewis St., $25,805 est. $26,000; 9 blocks Yorktown Ave. from 21st to Forrest Sts., 26 ft., to Calumet Constr. Co., 840 East Apache St., $36,271 est. $38,000.

Tennessee—State Dpt. Hys. & P. Wks., Nashville, concrete surfacing 10.624 mi. roads in Cumberland and Putnam Counties, to Foster & Creighton, 4th and 1st Natl. Bank Bldg., Nashville, $198,482—9.503 mi. Cumberland Co., to Murray Constr. Co., 508 Union Ave., Knoxville, $185,282—grading, drainage structures 6.594 mi. Polk Co., to R. E. Martin, Cotton States Bldg., Nashville, $116,192—5.436 mi. Hamblen Co., to E. J. Freeman, 1101 North Bway., Knoxville, $61,115—5.335 mi. Wilson Co., to J. A. Sutherland Co., Knoxville, $28,288. Grand total $589,359. Noted Jan. 15.

Wyoming—State Hy. Comn., Cheyenne, base course surfacing 29.26 mi. Johnson and Sheridan Counties, to S. F. Ronde, Sheridan, $18,999—28.96 mi. Converse Co., to T. J. Tobin Constr. Co., Casper, $82,567—grading 3.069 mi. Platte Co., to A. C. Smith & Co., Scottsbluff, Neb., $15,135, bridges, to Cannon & Webster, Douglas, $8,864—grading 13.78 mi. Sweetwater Co., to Morris Knudsen Co., Boise, Idaho, $72,863, bridges, to Green River Lumber Co., Green River, $5,587—grading for underpass Lincoln Co., to Wesley Corbett, Kemmerer, $2,359. Grand total $206,374. Noted Jan. 22.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Ill., Chicago—South Park Comrs., 5700 Cottage Grove Ave., soon takes bids filling in 12 acres made land to Northerly Island, from Roosevelt Rd. to 18th St., by pumping sand from lake bottom, constructing 750 ft. causeway from southeast tip of island to mainland, $600,000. E. J. Kelly, pres.

Constr. News page 64

Ind., Muncie—City, dredging White River to depth of 4 ft. through city. $100,000. W. Hartley, Muncie, engr.

Ind., Tipton—Bd. Comrs. Tipton Co., Lorina-Hilbert Drain in Madison and Tipton Twps. $26,410. J. O. Bowling, Tipton, engr.

Ia., Danbury—W. L. Egan, aud. Woodbury Co., Sioux City, bids in spring Reynolds Creek, 200,000 cu.yd. excav. E. L. Ferguson, 512 U. B. Bldg., Sioux City, engr.

BIDS ASKED

Louisiana—Mar. 4, by Bd. Comrs. Arnaudville Gravity D. D. 17, St. Landry and St. Martin Parishes, at Arnaudville, gravity drainage system, incl. 2,000,000 cu.yd. earth, using draglines and floating dredges. M. J. Goudeau, Opelousas, engr.

Okla., El Reno—Feb. 27, by C. E. Bross, clk. Canadian Co., drainage work in Banner D. D. 6. $25,000. H. G. Powell, El Reno, engr.

CONTRACTS AWARDED

Calif., Turlock—A. Sorensen, secy. Turlock Irrigation Dist., 2 in. concrete canal lining, miscellaneous fixtures, to Alldrin & Anderson, Turlock, $25,762, L. W. Terrell, Turlock, $16,396, and to E. Erickson, Turlock, $26,079. Noted Jan. 15.

Ill., Urbana — Bd. Comrs. Champaign Co., 8,000 lin.ft. open ditch work in Little Vermilion Special Drainage Dist., incl. 14,000 cu.yd. excav., to R. F. Stubblefield, Indianola.

Kan., Muscotah—Bd. Directors Delaware D.D. 2, 10 mi. flood control along Walnut Creek and Delaware River, 5 mi. on Grasshopper Creek, 4 mi. tributaries, 2½ mi. east of Whiting, to A. L. Hottman, Coulter, $77,257. Noted Jan. 8.

N. J., Long Branch—Bd. City Comrs., City Hall, stone, timber jetties at Pavilion Ave., to Wooley & Howland, Inc., Long Branch. Est. $25,000. Noted Dec. 4.

N. Y., Long Beach—City Council, J. J. McCabe, clk., City Hall, Park Ave., constructing, extending 5 jetties, to E. H. Mooney & F. Alternative, 171 Bay 26th St., Brooklyn, $24,750. Noted Jan. 1.

O., Cincinnati—Cincinnati, Union Terminal Co., Terminal Bar Bldg., rein.-con. retaining walls, incl. 2,900 cu.yd. earth excavation, 3,900 cu.yd. rein.-con., 137 tons reinforcing and 29.3 tons structural steel, to Hickey Bros. Constr. Co., 4200 Spring Grove St., $61,441.

Wash., Seattle—See "Factories and Mills."

FEDERAL GOVERNMENT

PROPOSED WORK

D. C., Wash.—POST OFFICES, etc.—Treas. Dpt. at office Sup. Archt., new building program submitted to House Appropriations committee calls for expenditure of $68,764,000 as follows: 227 projects outside of District of Columbia $50,665,000, five projects in District of Columbia $18,764,000.

La., New Orleans—EXCAVATOR—U. S. Eng., 1 truck dragline excavator.

Me., Rockland — LIGHTHOUSE DEPOT — Superintendent Lighthouses, Portland, lighthouse depot, Rockland Harbor. Private plans.

Mass., Camp Devons (mail Boston)—QUARTERS — Constructing Quartermaster, revised plans non-commissioned officers quarters, officers quarters and magazine. Noted Mar. 13.

N. Y., New York — FEDERAL COURT — Treas. Dpt. at office Sup. Archt., federal court building, 505 Pearl St.

N. Y., New York—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, West Bway., Church, Barclay and Vesey Sts. **Maturity late spring.** Noted Jan. 10, 1929.

Pa., Altoona—POST OFFICE—Treas. Dpt. at office Sup. Archt., plans by Royer & Anglemeyer, Commerce Bldg., 11th Ave. and 15th St., 1 story, basement, 125 x 200 ft., brick, stone, 12th St. and 11th Ave.

BIDS ASKED

Arizona—ROAD—Mar. 3, by Pub. Rds., San Francisco, Calif., grading, oil treated crushed rock surfacing 9.95 mi. Bright Angel Springs-North Entrance Rd., Grand Canyon Natl. Park, Coconino Co. C. H. Sweetser, 807 Sheldon Bldg., San Francisco, Calif., dist. engr. Noted Oct. 23.

Calif., March Field—HOSPITAL—Feb. 17, by Con. Q. M., constructing, completing Air Corps Hospital addition. Noted Nov. 20.

D. C., Wash.—GRANITE FACING—Mar. 4, by Executive Officer Arlington Memorial Bridge, 61,500 cu.ft. granite facing for memorial entrance to Arlington Memorial Bridge; adv. E. N.-R. Feb. 12.

Kan., Dodge City—POST OFFICE—Mar. 2, by Treas. Dpt. at office Sup. Archt., U. S. Post Office.

La., New Orleans—HOSPITAL—Treas. Dpt. at office Sup. Archt., bids about Feb. 15, nurses' home, officers quarters, at U. S. Marine Hospital.

Mo., Robertson—WOODWORKING MACHINE—Feb. 17, by Bureau Supplies & Accounts, Navy Dpt., woodworking machine to Naval Reserve, Aviation Base (St. Louis Flying Field).

Minn., Minneapolis—FEDERAL—Mar. 3, by Treas. Dpt. at office Sup. Archt., remodeling, enlarging U. S. Federal Office Building, adv. E. N.-R. Feb. 12.

O., Conneaut—POST OFFICE—Feb. 20, by Treas. Dpt. at office Sup. Archt., U. S. Post Office.

Okla., Frederick—POST OFFICE—Mar. 4, by Treas. Dpt. at office Sup. Archt., U. S. Post Office.

Pa., Pittsburgh—FOUNDATIONS—Mar. 3, by Treas. Dpt. at office Sup. Archt., foundations for U. S. Post Office.

R. J. Newport—HOSPITAL—Spec. 6403—Feb. 25, by Yards & Docks, Navy Dpt., main hospital extension, at Naval Station. Noted Oct. 30.

S. C., Parris Island—PAVING—Spec. 6410—Feb. 25, by Yards & Docks, Navy Dpt., concrete and bituminous paving, wire fencing, at Marine Barracks, adv. E. N.-R. Feb. 12.

Tenn., Chattanooga—QUARTERS—Feb. 24, by Con. Q. M., quarters at Fort Oglethorpe.

Tenn., Union City—POST OFFICE—Mar. 2, by Treas. Dpt. at office Sup. Archt., remodeling, enlarging U. S. Post Office, adv. E. N.-R. Feb. 12.

Va., Langley Field — SEWAGE PLANT — Mar. 10, by Con. Q. M. Fort Monroe, sewage disposal plant, Lighter-Than-Air Section, Langley Field; adv. E. N.-R. Feb. 12.

China, Shanghai — EMBASSY — State Dpt., Wash., D. C., bids about Mar. 15, embassy building.

CONTRACTS AWARDED

Calif., Oakland—FOUNDATIONS—Treas. Dpt. at office Sup. Archt., foundations and excavation for U. S. Post Office, to Schulerand McDonald, 1723 Webster St., Oakland, $108,777. Noted Jan. 1.

Calif., Pomona—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Office, to Los Angeles Constr. Co., 4816 West Pico St., Los Angeles, $141,800. Noted Jan. 1.

Calif., Santa Ana—POST OFFICE—Treas. Dpt. at office Sup. Archt., 2 story, part basement, brick, steel, rein.-con., to R. J. Chute Co., 2506 West Santa Barbara Ave., Los Angeles, $148,710. Noted Jan. 22.

Missouri and Arkansas—DREDGING—U. S. Eng., 1006 McCall Bldg., Memphis, Tenn., 1,050,000 cu.yd. Piece 23, in Lower St. Francis Levee Dist., near Gayoso, Mo., by day labor and government plant; 38,000 cu.yd. Piece 44A near Snow Lake, Ark., and 22,000 cu.yd. Piece 44B, near Laconia, Ark., both in White River Levee Dist., to E. H. Polk, Helena, Ark., at $0.20 per cu.yd.

Mo., Aurora—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Rosen & Fischel, 11 South LaSalle St., Chicago, Ill., $58,150. Noted Jan. 8.

Mo., Chamois—DIKE—U. S. Eng., Kansas City, 9,585 ft. standard pile dike 1 mi. from here, to Ross Constr. Co., 25th and Summit Sts., Kansas City, $194,300. Noted Dec. 11.

Mo., West Plains—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Rosen & Fischel, 11 South LaSalle St., Chicago, Ill., $52,447. Noted Jan. 1.

N. J., Raritan—DREDGING—U. S. Eng., 39 Whitehall St., New York, in upper Raritan River, to Dunbar & Sullivan Dredging Co., 2312 Buhl Bldg., Detroit, Mich., $280,664. Noted Jan. 1.

N. Y., New York—ELEVATOR PLANT—Treas. Dpt. at office Sup. Archt., elevator plant in Appraiser's Stores, to Haughton Elevator & Machine Co., Vermont Bldg., Wash., D. C., $57,928.

Pa., Lewisburg — PENITENTIARY — Treas. Dpt. at office Sup. Archt., U. S. Penitentiary, to Great Lakes Constr. Co., 333 North Michigan Ave., Chicago, Ill., $2,781,000. Noted Jan. 8.

S. C., Dillon—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to A. Blair, 1st Natl. Bank Bldg., Montgomery, Ala., $43,595. Noted Jan. 8.

Tex., Randolph Field — OFFICERS QUARTERS—Con. Q. M., 2 story, basement, company officers quarters, to G. Wieland, 106 East 25th St., Austin, $197,217. Noted Dec. 25.

FEDERAL POWER COMMISSION

Applications for License and Permits Licenses

1145—Cascade Utilities Co., Oakridge, Ore., wants license power project on Salt Creek, within Cascade Natl. Forest, Lane Co.

1146—California Oregon Power Co., 58 Sutter St., San Francisco, Calif., wants license transmission line partly on public lands and partly within Klamath Indian Reservation in Klamath Co., Ore.

1147—Idaho Power Co., Boise, Idaho, wants license transmission line within Fort Hall Indian Reservation, Bingham and Bannock Counties.

1148 — Montana Power Co., Butte, Mont., wants license transmission line partly within Beartooth Natl. Forest, Stillwater Co.

1149—R. E. DeKay, 1112 Tremaine St., Los Angeles, Calif., wants preliminary permit power project on Lost Creek, Deerlodge Natl. Forest, Deerlodge Co., Mont.

RAILWAYS

PROPOSED WORK

Ohio—Sandusky Connecting Rys. Co., Sandusky, 2½ mi. electric line of overhead trolley type from tracks of Lakeshore Electric Co. south of intersection of Columbus and Perkins Aves. to tracks of Lake Shore Rys. Co., near intersection of Tiffin Ave. and Venice Rd., in Sandusky, $75,000-$100,000.

SUBWAYS AND TUNNELS

BIDS ASKED

Pa., Phila.—Feb. 17, by Dpt. City Transit, City Hall Annex, C. E. Myers, dir., repairs, changes to subway station equipment at 1410 Ludlow St., Park Ave. and Cumberland St., and 1333 Mt. Vernon St., Contr. 232.

CONTRACTS AWARDED

Que., Montreal—City Council, subway at St. Hubert St., to Atlas Constr. Co., 37 Belmont St., $165,277.

GRADE CROSSINGS

PROPOSED WORK

N. J., Lakewood—Bd. Freeholders Ocean Co., Court House, Toms River, preliminary plans double underpass at Lakewood railroad crossing on Lakewood-Adelphi Rd. and Lakewood-Toms River Rd. $25,000 or more. H. C. Shinn, Municipal Bldg., co. engr.

N. J., North Bergen—Bd. Freeholders Hudson Co., Court House, Jersey City, and New York Central R.R. Co., F. B. Freeman, ch. engr., 466 Lexington Ave., New York, eliminating 2 grade crossings at River Rd. and railroad tracks, $25,000 or more. F. J. Radigan, Jersey City, co. engr.

Ont., Hamilton — City, W. L. McFaul, city engr., steel, concrete subway under Canadian National Ry. lines, Barton St., incl. concrete abutments, retaining walls, steel, concrete spans, $50,000.

DAMS

PROPOSED WORK

Tex., Corpus Christie—See "Waterworks."

PIERS AND WHARVES

PROPOSED WORK

Mass., Yarmouth — PIER, etc. — G. Breed, Lewis Bay, timber pier, marine railway, timber piling, Lewis Bay. $25,000. Private plans.

Tex., Beaumont—WHARF—City, c/o P. Millard, mgr., voted $1,200,000, wharf expansion program. R. C. Black, Beaumont, city engr.

Va., Hopewell—PIER—Atmospheric Nitrogen Co., Hopewell, subsidiary Allied Chemical & Dye Co., 61 Bway., New York, sketches additional pier. To exceed $500,000. **Maturity in April or later.**

CONTRACTS AWARDED

Calif., Oakland—PIER SUBSTRUCTURE—City of Oakland, Port Comn., 424 Oakland Bank Bldg., G. B. Hegardt, secy., concrete pier substructure, foot Webster St., to M. B. McGowan, Call Bldg., San Francisco, $121,844. Noted Dec. 18.

AIRPORTS

PROPOSED WORK

Mass., East Boston — Commonwealth of Massachusetts, National Guard Comn., J. Agnew, State House, Boston, sketches by Hendrick & Hayward, 192 Boylston St., Boston, 2 story, brick, steel, concrete air corps building, at airport, Porter St. $250,000.

GRAIN ELEVATORS

PROPOSED WORK

N. Y., Buffalo—GRAIN ELEVATOR—Russell Miller Milling Co., foot Childs St., grain elevator addition, increasing capacity 1,500,000 bu. To exceed $1,000,000.

Tex., Amarillo—GRAIN ELEVATOR—Burrus Milling Co., Amarillo, and 2701 Alamo St., Dallas, 1,000,000 bu. rein.-con. $250,000. Private plans.

CONTRACTS AWARDED

N. Y., Buffalo—GRAIN ELEVATOR—Amer. Elevator Co., foot Childs St., 1,500,000 bu. rein.-con., foot Childs St., to Monarch Eng. Co., Chamber of Commerce Bldg. Est. $300,000.

POWER AND LIGHTING

PROPOSED WORK

Colorado — Southern Colorado Power Co., Pueblo, expending $240,000 during 1931, incl. additions to distribution lines and services for supplying ranges, major appliances, also additional transformer capacity at La Junta, new outdoor substation for Ordway Dist., increasing transmission line capacity between Rocky Ford and Ordway.

Ont., Windsor — City, installing conduits in various sections for fire, police and traffic signals. $57,274. R. J. Desmarais, City Hall, engr.

CONTRACTS AWARDED

Calif., Los Angeles—Bd. P. Wks., City Hall, ornamental lighting system in Magnolia Blvd. between Cahuenga Blvd. and Tujunga Ave., to Walker-Martin Corp., 1241 East Florence Ave., $31,462.

Calif., San Bernardino — Southern Sierras Power Co., c/o California Nevada Electric Co., Riverside, power transformer and substation equipment, to Westinghouse Electric & Mfg. Co., 150 Bway., New York. Est. exceeds $50,000.

Massachusetts—New England Power Assn., 89 Broad St., Boston, transmission line, station, between Royalston and Athol, to New England Power Constr. Co., 89 Broad St., Boston. Est. exceeds $25,000.

N. Y., Creedmoor—Dpt. Mental Hygiene, State Office Bldg., Albany, electric connections and power plant equipment at Brooklyn State Hospital, to T. F. Jackson, 25 West 43rd St., New York, $97,850.

PARKS AND SPORTS

PROPOSED WORK

Ind., Noblesville—City, swimming pool in Forest Park. $25,000.

Mass., Foxboro—Town, H. C. Read, chn. Bd. Selectmen, playground and athletic field, incl. baseball diamond, football gridiron, tennis courts, grandstand, etc., at rear of high school. $50,000.

Mass., Quincy—Finance Corp. of New England, 31 Milk St., Boston, rebuilding 1 story, roller skating rink, Quincy Shore Dr., recently destroyed by fire. $35,000. Engineer not selected.

Mo., St. Louis—Water Dpt., L. Day, comr., City Hall, preliminary plans developing 50 acres hilly land for park, southwest of Howard Bend Water Works, on Missouri River, incl. 7,600 ft. macadam roadway from park to Olive Street Rd. $75,000. Private plans.

N. J., Livingston — Bd. Educ. preliminary plans improving Roosevelt and Harrison School grounds, incl. drains, grading, concrete walks, drives. $25,000.

N. J., Roselle Park — Union County Park Comn., Acme St., Elizabeth, county park, near Roselle Athletic Field. $25,000 or more.

N. Y., Massapequa—C. W. Beall, c/o Long Island Zoological Park, Oceanside, amusement park, zoo. To exceed $150,000.

N. Y., Piermont—H. & H. Corp., c/o Lucht & Anderson, archts., 432 Palisade Ave., Cliffside, 2 story, basement, brick, frame bath house, pavilion, swimming pool. $150,000. Bids in. **Maturity indefinite.** Noted Jan. 22.

BIDS ASKED

Ind., Indianapolis—Feb. 24, by Bd. School Comrs., A. B. Good, bus. dir., portable steel bleachers for auditorium, gynasium at Arsenal Technical School, 1500 East Michigan St.

N. J., Union City—Bd. City Comrs., City Hall, bids about May 1, rein.-con. stadium tennis courts, running track, football field, at Summit Ave. and Hudson Blvd. $500,000. H. C. Thourot, 708 Bergenline Ave., city engr. G. W. Thompson, 324 Montgomery St., Syracuse, N. Y., archt. Noted Jan. 29.

N. Y., Babylon — Feb. 17, by Long Island State Park Comn., Administration Headquarters, Belmont Lake State Park, underpass under Ocean Blvd., incl. ramps, plazas, walks and paving parking field at Jones Beach; also installing pipe lines at Sunken Meadow State Park, Kings Park, and Jones Beach State Park, Wantagh. W. E. Andrews, acting ch. engr.; adv. E. N.-R. Feb. 12.

CONTRACTS AWARDED

N. Y., Brooklyn—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, improving Irving Square Park, to P. J. Hand Co., 510 Smith St., $12,000; rip rap along Shore Rd., to O'Brien Bros., foot Washington St., $155,761; improving Sunset Park, to C. Bennett Impvt. Co., 465 Fenimore St., $64,824; improving Bensonhurst Park and cement walks at sidewalks intersection Eastern Parkway, to Booth Constr. Co., 125 Court St., $4,326 and $9,969 respectively; new iron picket fence Winthrop Park, to Gottlieb Iron Wks., 444 West 38th St., New York, $9,604. Grand total $256,484. Noted Jan. 15.

HEATING AND VENTILATING

BIDS ASKED

Ind., Bloomington — Feb. 22, by Granger & Bollenbacher, archts., 333 North Michigan Ave., Chicago, Ill., heating and ventilating for 4 story, basement, 100 x 140 ft. union building, for Bd. Trustees Indiana University. Total est. $600,000. Noted Feb. 5 under "Schools."

CONTRACTS AWARDED

N. Y., Kings Park—Dpt. Mental Hygiene, State Office Bldg., Albany, heating work for service connections for new buildings at Kings Park State Hospital, to Afgo Eng. Corp., 142 Fulton St., New York, $42,980; electrical work, to Tucker Electric Constr. Co., 124 East 25th St., New York, $9,378. Noted Dec. 18.

N. Y., Ogdensburg—Commissioner Dpt. Mental Hygiene, State Office Bldg., heating work, additional boiler capacity, and equipment in St. Lawrence State Hospital, to A. D. Granger Co., 15 Park Row, New York, $26,087. Noted Dec. 18.

UNCLASSIFIED

PROPOSED WORK

Ohio—PIPE LINE—Susquehanna Pipe Line Co., c/o Sun Oil Co., S. B. Eckert, vice pres., Finance Bldg., Phila., Pa., proposed preliminary studies for pipe line (probably gasoline) between Cleveland and Toledo. **Maturity indefinite.**

Pa., Baden — RIVER RAIL TERMINAL — W. D. Wiggin, ch. engr., (Central Region) Pennsylvania R.R. Co., Pennsylvania Sta., Pittsburgh, soon lets general contract and mechanical equipment river rail terminal Ohio River. $350,000. Noted Dec. 8.

Pa., Gibsontown—DOCK—Pittsburgh Steel Co., Union Trust Bldg., Pittsburgh, 1,000 ft. piling and timber unloading dock, incl. 50 ft. concrete wall, on Monongahela River, Westmoreland Co. V. Chartener, Monnessen Plant, Monnessen, ch. engr.

BIDS ASKED

Ind., New Albany — TELEPHONE CABLES, etc.—See "Contracts Awarded."

Tex., Galveston—FISHING PIER—J. G. Nelson & Associates, 4439 Rawlings St., Dallas and Galveston, taking bids pleasure pier at 35th St. and Boulevard, monolithic rein.-con. with precast rein.-con. piling, 17 ft. square, 85 x 5 ft. long, 60,000 lb. load capacity per mile, pier will extend 700 ft. out into gulf with causeway 40 ft. wide, approaching pier pavilion and auditorium, 65 x 125 ft., extending 400 ft. into gulf, fishing pier in form of "T" auditorium, 1,500 seating capacity. $500,000. Noted Dec. 11.

CONTRACTS AWARDED

Ind., New Albany — TELEPHONE CABLES, etc.—Indiana Bell Telephone Co., laying cables in eastern section city, also additional telephone facilities, day labor, under supervision of owner, $48,000.

N. Y., Marcy—TUNNELS — Dpt. Mental Hygiene, State Office Bldg., Albany, service tunnels at Marcy Div., Utica State Hospital to Utica Constr. Co., Inc., 622 South St., $58,423; heating and hot waterlines, to Afgo Eng. Corp., 142 Fulton St., New York, $36,935; electrical work, to O'Connell Electric Co., 63 Mount Hope Ave., Rochester, $8,660. Grand total $104,018. Noted Jan. 15.

N. Y., New York—RECTIFIER SYSTEM—J. H. Delaney, chn. Bd. Transportation, 250 Hudson St., underground rectifier system, to Rodgers & Haggerty, Inc., 70 East 45th St., $287,396. Noted Jan. 15.

MATERIALS

BIDS ASKED

PIPE, PAINT, LUMBER, etc. — **Grundy Center, Ia.**—Feb. 16, at office Auditor Grundy Co., 5,968 lin.ft. 15- to 42-in. pipe, 700 machine bolts and washers, 100 gal. white paint, 75 gal. green graphite paint, 75 gal. red lead paint, 65 kegs nails, 98,480 bd. ft. standard sawed Douglas fir lumber "1930" Iowa State Highway Commission Specifications, 3,588 lin.ft. creosoted standard yellow pine piling.

LUMBER, GASOLINE, etc. — **Independence, Ia.**—See "Streets and Roads."

BROKEN STONE—**Maplewood, N. J.**—Feb. 14, by Twp. Com., Township Hall, 5,000 tons broken stone. $25,000. H. W. Heilman, 9 Highland Ave., twp. engr.

CRUSHED STONE, etc.—**Cleveland, O.**—Feb. 13, by City, crushed stone, slag, slag screenings and granulated slag for street repair department.

PORTLAND CEMENT—**Wisconsin**—Feb. 18, by State Hy. Comn., Madison, 1,341,643 bbl. portland cement for delivery during calender year, 1931.

FIRE ALARM REPEATER, etc.—**Milwaukee, Wis.** — Feb. 24, by Central Bd. Purch, J. A. Nicholson, purch. agt., for fire alarm repeater, 103,500 ft. wire for fire and police alarm system, 4,000 ft. for bureau Electric Service, 50,400 ft. block steel pipe, 4,200 ft. galvanized steel pipe, 3,000 block steel pipe couplings, 1 power sweeper, 1 power winch for truck, two 1 bag concrete mixers, two 7 ton platform trailers, one 2 ton platform trailor, 3 air compressors, 1 tandem roller, three 2 ton dump truck chassis, one 3 ton dump truck chassis, 3 steel dump bodies.

MANHOLE STEPS—**Milwaukee, Wis.**—Feb. 17, by Central Bd. Purchases, J. W. Nicholson, purch. agt., 10,000 malleable iron manhole steps, seven 12 and 20 in. gates valves, three 12 in. check valves, 25 tons c.i. water pipe and special castings, three 667 kva. and one 25 kva. transformers, 1 road marking machine.

ASPHALT CEMENT—etc.—**Hamilton, Ont.**—Feb. 18, by S. H. Kent, city clk., City Hall, furnishing annual supplies, incl. asphalt cement, crushed stone and screenings, limestone dust, asphalt sand, creosoted wood blocks, vitr. clay and concrete sewer pipe, castings, cast iron pipe and specials, wrought iron pipe, extension boxes, fuel oil, road oil, brooms, sweepers, duck covers, waterworks, ordinary and special brass, brass and bronze. $50,000. W. L. McFaul, City Hall, engr.

CONTRACTS AWARDED

PIPE—**Los Angeles, Calif.**—City purchasing Agent, City Hall, 38,000 ft. ¾ in., 5,000 ft. 1 in. 2,000 ft. 2 in. wrought steel galvanized pipe threaded and coupled for Park Dpt., in Elysian Park, to California Pipe & Steel Co., 2135 Atlantic Ave.

Constr. News page 65

Materials (Continued)

BRIDGE LUMBER, POSTS, etc. — Primghar, Ia.—Auditor O'Brien Co., 38,400 ft. 3 x 12—16 ft. fir standard sawed creosoted bridge flooring, 7,200 ft. 10 x 10—18 ft. fir standard sawed creosoted bridge caps, 30,000 ft. 3 x 12—16 ft. fir full sawed S1S1E bridge flooring, 3,000 ft. 10 x 10—18 ft. fir standard sawed bridge caps, 168 ft. 6 x 6—28 ft. fir standard sawed S4S pile leads, 50 pieces 16 ft., 50 pieces 18 ft., 15 pieces 20 ft. cypress piling, to E. S. Gaynor Lumber Co., Sioux City, $5,052; 200 pieces 16, 18, 20, 22 and 24 ft. creosoted Southern yellow pine piling, to Primghar Lumber Co., Primghar, $2,098; one thousand eight fifty 5 and 6 in. white cedar guardrail and culvert posts 7 ft. long, 3,600 lin.ft. 15, 18 and 24 in. culvert pipe, to Wilson Concrete Co., Red Oak, $1,520. Grand total $8,670. Noted Jan. 22.

BRIDGE LUMBER and CULVERT PIPE — Waterloo, Ia.—Auditor Black Hawk Co., 152,733 ft. b.m. full sawed rough fir bridge lumber, 6,480 ft. creosoted yellow pine, and 1,813 ft. creosoted yellow pine piling, to W. W. Saylor, Waverly, $6,171; 6,960 ft. 15- to 36-in. corrugated metal culvert pipe, to Klauer Mfg. Co., Waterloo, $4,978.

SLAG—Detroit, Mich.—Dpt. P. Wks., City Hall, 75,000 tons slag, for season, to Ford Motor Co., River Rouge Plant, Dearborn, at $0.95 per net ton at plant and $1.30 per net ton, delivered. Est. $71,250.

JOINT FILLER, etc.—New York, N. Y.—Manhattan Boro, Municipal Bldg., 600 tons joint filler, to Warner Quinlan Co., 26 Beaver St., $9,588; 8,000 cu.yd. binderstone,, to New York Trap Rock Co., 103 Park Ave., $15,600; 25,000 bags cement, to J. A. McCarthy & Co., Inc., 479 Walton Ave., $13,188. Grand total $38,386. Noted Jan. 15.

EQUIPMENT

PROPOSED WORK

TRACTOR and PLOW—Cummington, Mass.—Town, L. A. Stevens, moderator, purchasing tractor and plow. $5,000 appropriated.

STREET EQUIPMENT—North Adams, Mass.—City, E. R. Doble, com. P. Wks., purchasing power grader and scarifier, gasoline shovel or portable loader.

BIDS ASKED

ROAD GRADER—**Anaheim, Calif.**—Feb. 24, by E. B. Merritt, city clk., road rader.

EXPANSION JOINTS—**Iowa**—Feb. 17, by State Hy. Comn., Ames, 1,000 pieces 1 x 8 in. x 9 ft. expansion joint, delivered in car lot to Ames.

MAINTAINERS, etc.—**Montezuma, Ia.**—Feb. 19, at office Auditor Poweshiek Co., 6 one-man maintainers, 1 crawler type tractor, 1 excavator.

FOREIGN

Africa—Dovan Chemical Co., 30 Church St., New York, soon lets contract chicle extraction works, equipment, at King Williamstown, British South Africa. To exceed $40,000.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

Conn., Stamford—Rippowan Village Corp., 527 5th Ave., New York, soon lets general contract 3 story, 70 x 98 ft. brick, Rippowan Village Rd. $125,000-$150,000. S. Goldstone, 265 Madison Ave., New York, archt.

La., Baton Rouge—Interstate Hotel Co., c/o A. Glassell, Shreveport, soon lets contract. $200,000. E. F. Neild, Shreveport, archt. Noted Feb. 5.

Mass., Cambridge—J. A. Carrig, 1374 Mass. Ave., taking bids 4 story, basement, 80 x 125 ft., brick, stone, plain found., 334 Harvard St. $160,000 or more. H. Harlow, 4 Brattle St., archt. Foundation awarded to J. F. White Constr. Co., 56 Ellery St. Noted Jan. 8, under "Contracts Awarded."

N. J., East Orange—See "Contracts Awarded."

N. J., North Bergen—J. Ninivaggi, 1297 2nd Ave., Woodcliffe, taking bids general contract 3 story, basement, brick, steel, 1299-1301 2nd Ave. $150,000. M. Kraut, 3010 Hudson Blvd., Jersey City, archt.

N. J., North Bergen — See "Contracts Awarded."

N. Y., Long Island City—See "Contracts Awarded."

CONTRACTS AWARDED

N. J., East Orange—Morris Mandelbaum Associates, 7 East 42nd St., 3 and 4 story, basement, brick, steel, plain found., Irvington Ave., separate contracts. $200,000. Bids now being taken. Harris & John, 7 Mechanic St., Newark, archts. Noted Aug. 21.

N. J., North Bergen—Harris Brustin, 1226 1st Ave., 3 story, basement, brick, steel, plain found., 1231-33 1st Ave., separate contracts. $150,000. Barney Singer, 921 Bergen Ave., Jersey City, archt.

Constr. News page 66

N. J., North Bergen — I. and M. Kusehuk, and B. Scherb, 295 Central Ave., Union City, 3 story, basement, brick, steel, 1181-83 4th Ave., separate contracts. $150,000. M. Kraut, 3010 Hudson Blvd., Jersey City, archt.

N. Y., Long Island City—Presco & Soririo, 90-73 Sutphin Blvd., Jamaica, apartments DeKalb St. and East Cypress Ave., separate contracts. $150,000. Private plans.

N. Y., Rochester—Stanwood Apartments, 699 Main St., E. remodeling, enlarging apartments, to Poze & Natapow, 488 St. Paul St. Est. $250,000.

CLUBS

PROPOSED WORK

Fla., Tampa—Y. M. C. A., Tampa, and Natl. Bd. Y. M. C. A., 600 Lexington Ave., New York, soon take bids (selected list local contractors), Y. M. C. A. building. To exceed $150,000. L. Elliott, 706 Franklin Ave., archt.

N. J., West Orange—Essex County Country Club, Hutton Park, altering and constructing 2 store, basement, brick addition. $150,000. **Maturity probably soon.** Architect not selected.

N. Y., Brooklyn—Brooklyn and Queens Y. M. C. A., Church Ave., Y. M. C. A. building, East 21st St. and Church Ave. $550,000. **Maturity about December.** Voorhees, Gmelin & Walker, 101 Park Ave., archts. Noted Dec. 12, 1929.

BIDS ASKED

N. J., Newark—D. R. Rizzolo, archt., 625 North 6th St., taking bids general contract 4 story, basement, brick, steel, temple and stores addition, 42-44 Hill St., for I. O. O. F. Three Link Temple, Inc., 42 Hill St., est. $150,000. Noted Nov. 21, 1929.

CONTRACTS AWARDED

Mass., Brockton—Y. W. C. A., B. H. Sprague, 465 Main St., altering and constructing 3 story, basement, brick, stone, steel addition, plain found., to Gibson & Williams, Inc., 65 Long Wharf, Boston. Est. $150,000. Noted Jan. 15.

HOSPITALS

PROPOSED WORK

Conn., Mansfield—State, Mansfield State Training School, nurses' home and school additions. $200,000. Architect not selected.

Neb., Omaha—See "Contracts Awarded."

N. Y., Hastings-on-Hudson — Jewish Mental Health Society, general contract hospital. $150,000. Gehron & Ross, 101 Park Ave., New York, archts. Project in abeyance. Noted Oct. 2.

N. Y., Suffern—Good Samaritan Hospital revised sketches 3 story, basement, brick, steel hospital. $300,000. Noted Nov. 10 Daily.

Ont., London—Victoria Hospital Trust, W. M. Gartshore, chn., J. Falls, supt., sketches by Watt & Blackwell, Victor Bldg., Dundas St., hospital buildings. $1,000,000.

BIDS ASKED

N. J., Preakness—Bd. Freeholders Passaic Co., Court House, Paterson, bids about Mar. 15, 3 story, basement, 40 x 300 ft., brick, steel welfare house and detention home, Oldham Rd. $500,000. F. W. Wentworth, 140 Market St., Paterson, archt. Noted Feb. 5.

CONTRACTS AWARDED

Calif., Agnew—State of California, Sacramento, general contract 2-story rein.-con., ward, kitchen and commissary building at Agnew State Hospital, to J. F. Shepherd, 406 1st Natl. Bank Bldg., Stockton, $194,500; plumbing, heating and ventilating, to Hateley & Hateley, 1710 10th St., Sacramento, $40,572; electrical work, to Gilbert Bros. Electric Co., 286 West Santa Clara St., San Jose, $7,229. Grand total $242,301. Noted May 15.

Calif., San Francisco—S. J. Hester, secy. Bd. P. Wks., City Hall, general contract steel, brick roof ward additions, to Barrett & Hilp, 918 Harrison St., $269,837; plumbing, to Turner Co., 329 Tehama St., $38,225; heating, to J. A. Nelson, 10th and Howard Sts., $17,694; steel, to McClintock-Marshall Co., 2050 Bryant St., $19,070 for City and San Francisco Co. (exclusive of erection) Grand total $344,482. Rejected bids on electrical work, will re-advertise. Noted Dec. 25.

Neb., Omaha—Douglas Co., G. Berger, clk., general contract 5 story, basement, rein.-con., brick, steel, stone, incl. 3 wings, service, 42nd St. and Woolworth Ave., to V. R. Gould & Son, City Natl. Bank Bldg., $498,914. Bids later on sub-contracts.

N. Y., Brooklyn—Dpt. Hospitals, J. G. W. Greef, comr. Municipal Bldg., general contract nurses home Greenpoint Hospital, to Seaman Constr. Co., 145 West 27th St., New York, $222,000; plumbing, to H. Homer & Son, 1425 59th St., Brooklyn, $37,000; electrical work, to Pyramid Electric Contg. Co., 228 East 41st St., New York, $11,489. Grand total $270,489. Noted Jan. 22.

CHURCHES

PROPOSED WORK

N. J., Jersey City—J. Ives & Chase, lessees, 521 5th Ave., New York, bids about May, general and separate contracts 12 story, basement, brick, steel church, apartments, Sip and Tonnelle Aves., for First United Presbyterian Church, W. Bell, pastor, 30 Tonnelle Ave. $500,000. G. G. Miller, 545 5th Ave., New York, archt. Noted Jan. 15.

N. J., New Brunswick — Christ Episcopal Church, W. H. Stowe, pastor, 216 Larence St., 2 story, basement, brick, steel rectory, College Ave. between Richardson and Huntington Sts. $150,000. **Maturity indefinite.** P. L. Fowler, 224 East Hanover St., Trenton, archt.

N. J., Rutherford—Rutherford Congregation Church, C. E. Dunn, pastor, 23 Sunderland Ave., 2 story, basement, brick, steel, Union Ave. $150,000. **Maturity about May.** Architect not selected. Noted Dec. 18.

N. Y., New York—Fourth Church of Christ Scientist, Fort Washington Ave. and 178th St., bids after Mar. 1, church, Fort Washington Ave. $200,000. Cherry & Matz, 441 Lexington Ave., archts. Noted Jan. 22.

BIDS ASKED

Okla., Tulsa—H. Iola, rabbi, Jewish Temple, 207 East 27th St., taking bids part 1 and 2 story, 150 x 150 ft., brick, concrete, steel temple, incl. gymnasium, 16th and Rockford Sts. $150,000. D. McCormick, Exchange Natl. Bank Bldg., archt.

CONTRACTS AWARDED

Mo., St. Louis — Memorial Presbyterian Church, 21 South Skinker Blvd., general contract 2 story, basement, brick, stone, concrete church auditorium unit, to Murch Bros. Constr. Co., Railway Exch. Bldg. Est. $250,000.

SCHOOLS

PROPOSED WORK

Ind., Indianapolis — School Comrs., A. B. Good, dir., 150 North Meridian St., plans by D. A. Bohlen & Son, 1001 Majestic Bldg., Grade School 56, rein.-con., brick, 24th and Martindale Sts. $150,000.

Md., Baltimore—Mayor and City Council, City Hall, plans by Mackenzie & Cross, 330 North Charles St., 3 story, basement, brick, steel, concrete school for handicapped children, North, Windsor, Warwick and Wheeler Aves. $600,000.

Md., Baltimore — Mayor and City Council, Keyser Bldg., plans by Wyatt & Nolting, Keyser Bldg., Southeast High School, 3 story, basement, brick, steel, concrete, Ellwood, Robinson, Pratt and Lombard Sts. $700,000.

Mass., Arlington (br. Boston)—Town, Bd. Selectment, plans by T. F. Jackson, 44 School St., Boston, brick elementary school, Eastern Ave. $225,700 appropriation granted. Fay, Spofford & Thorndike, 44 School St., Boston, engrs.

Mass., Brookline—Town, Bd. Selectmen, altering and constructing 2 story, basement, brick high school addition. To exceed $150,000. Architect not selected.

Mass., Wakefield — Town, J. L. McMahon, chn. Building Com., revised plans by J. W. Beal Sons Co., 185 Devonshire St., Boston, 2 story, basement, brick, stone intermediate school, Main St. $350,000. Stone-Underhill Co., 171 Harrison Ave., Boston, engrs.

Mass., Westwood—Town, A. H. Williamson, supt. schools, 2 story, basement, brick school. $150,000. Architect not selected.

Mass., Wilmington—Town, J. Hathaway, chn. school comn., new 2 story, basement, brick high school. $200,000. Architect not selected. Project formerly reported as bids for alterations and addition is in abeyance and probably be abandoned for above work. Noted July 24.

N. J., Butler—Bd. Educ., High school, 2 story, basement, brick, steel high school addition, Bartholdi Ave. $200,000. Project in abeyance. Noted, Dec. 25.

N. J., Elizabeth—Bd. Educ., 417 South Broad St., 2 story, basement, brick, steel, South St. $200,000. Project in abeyance. H. B. Brady, Inc., 333 Broad St., archt. Noted Oct. 9.

N. J., Garfield—Bd. Educ., Palisade Ave., 2 story, basement high school. $250,000. **Maturity about July 1.** Noted Oct. 24, 1929.

N. J., Jamesburg—Bd. Educ., 2 story, basement, brick, steel high school. $150,000. **Maturity probably soon.** Architect not selected.

N. J., Jersey City—Bd. Educ., Administration Bldg., 3 story, basement, brick, steel addition to Dickinson High School, Palisade Ave. $450,000. Project in abeyance. J. T. Rowland, Jr., 30 Journal Sq., archt. Noted Oct. 23.

N. J., New Brunswick—Rutgers College. J. G. Lipman, Dir. State Agricultural Experiment Station, College Farm, brick, steel soil science building, State Experimental Farm. $150,000. **Maturity indefinite.** Architect not selected.

N. J., Ridgefield Park—Bd. Educ., Overpeck Twp., G. Noethling, dist. clk., revised sketches by Hacker & Hacker, 201 Main St., Fort Lee, 2 story, basement, brick, steel, addition, Teaneck Rd. $150,000. Noted Apr. 17.

N. J., Springfield — Bd. Educ., Short Hills Ave., sketches by J. T. Simpson, 45 Walnut St., Newark, 2 story, basement, brick, steel high school, plain found. $300,000. Noted Jan. 1.

N. J., Union City—Bd. Educ., 415 32nd St., Central High School, 3 story, basement, brick, steel. $150,000 or more. **Maturity in 1932.** Architect not selected. Noted Jan. 29.

N. Y., Great Neck—Bd. Educ., bids about Mar. 1, 2 story, basement, brick, steel, rein.-con. school. $150,000. Guilbert & Betelle, 20 Branford Pl., Newark, N. J., archts. Noted Jan. 29.

Pa., College Hills (mail Beaver Falls) — Geneva College, M. M. Pearce, pres., sketches brick, stone gymnasium building, on campus, $150,000.

Pa., Roaring Springs—Bd. Educ., C. Stevens, secy., sketches Junior High School. **Maturity in couple years.** Architect not selected.

Schools (Continued)

Ont., Toronto—Bd. Educ., 155 College St., additions to schools as follows: 3 story, basement, to Oakwood Collegiate, $125,000; 5 rooms, auditorium to Runnymeade School, $89,000; 3 room to Morse School, $47,000; 2 rooms, gymnasium, swimming pool, to Leslie St. School, $95,000; all foregoing, concrete, brick, steel. C. Dyson, 155 College St., archt.

BIDS ASKED

Calif., Los Angeles—R. Montgomery, arch., Chamber of Commerce Bldg., taking bids 2 story, 60 x 285 ft. brick administration and residential building, Beverly Blvd., for Marymount school, c/o architect. $175,000. Noted Jan. 29.

Conn., West Haven (br. New Haven)—Feb. 17, by Town, School Bd., altering and constructing 2 story, basement, brick, rein.-cor. addition, plain found., Forest Rd. $150,000. D. E. Smith, 152 Temple St., New Haven, archt. Noted Jan. 29.

Ill., Chicago — Feb. 24, by Bd. Educ., 188 West Randolph St., Wells Junior High School, concrete, cut stone, terra cotta, incl. lunch room, auditorium, library, power plant, civics, administration, power plant, shops, swimming pool, drawing room, printing shop, Ashland, Augusta, Mansfield and Walton Aves. $2,000,000. P. Gerhardt, c/o owner, archt.

Mass., Brighton (sta. Boston) — St. John's Ecclesiastical Seminary, Lake St., taking bids 3 story, basement, brick, stone seminary, plain found., Foster St. $150,000-$175,000. M. P. Meade, 80 Boylston St., Boston, archts. Noted Dec. 4.

Mich., Detroit—Feb. 18, by C. A. Gadd, bus. mgr. Bd. Educ., 1354 Broadway Ave., 2 story, basement, brick, steel, stone, concrete addition and power house for heating purposes, plain found., Freeland Ave. $232,800. Stratton & Hyde, 904 Marquette Bldg., archts.

Mo., Kansas City—Bd. Educ., Library Bldg., bids about Feb. 15, general contract 2 story, basement, brick, rein.-con. school addition. $170,000. C. A. Smith, 800 Finance Bldg., archt.

N. J., Glen Rock—Bd. Educ., Boro Hall, bids about Mar. 1, general contract 2 story, basement, brick, steel, rein.-con. addition. $150,000. Adams & Prentice, 15 West 38th St., New York, archts. Noted Jan. 8.

N. J., Hillside (sta. Elizabeth)—Bd. Educ., H. Doremus, pres., Township Hall, bids about Feb. 1, general contract 2 story, basement, brick, steel, rein.-con., plain found., to Schurman Constr. Co., 861 Lexington Ave., Passaic. Est. $175,000. Noted Nov. 13.

N. J., Phillipsburg—Bd. Educ., High School, bids probably about Apr. 1, 2 story, basement, brick, steel, plain found., Ingersoll Heights. $150,000. A. Merchant, 1 Elm Row, New Brunswick, archt. Noted Jan. 15.

N. J., Westwood — Bd. Educ., High School, bids about Mar. 1, altering and constructing 2 story, brick, steel, rein.-con. high school addition, 3rd Ave. $200,000. A. E. Dore, 173 Main St., Hackensack, archt. Noted Dec. 18.

N. Y., Oswego—Mar. 5, by Bd. Educ., general contract industrial teachers training school, at New York State Normal School. $300,000. Noted Dec. 25.

N. Y., Sloan—F. Spangenburg, arch., 250 Delaware Ave., bids about Feb. 15, general contract 3 story, rein.-con. addition to Halstead Ave. school, for Union Free School Dist. 9. $270,000.

CONTRACTS AWARDED

D. C., Wash.—District Comrs., District Bldg., Deanwood School addition, to A. L. Smith & Co., 2525 Pennsylvania Ave., $135,000; 12 room addition and 2 gymnasiums at Gordon Junior High School, to G. E. Wynne, 2525 Pennsylvania Ave. N.W., $135,000. Noted Jan. 8.

Ill., Chicago—Bd. Educ., 188 West Randolph St., E. Whithall, bus. engr., general contract Wendell Phillips Senior High School, rein.-con., brick, stone, incl. 3 gymnasiums, lunch room, laboratories, science hall, shops, lecture halls, to H. A. Hanson Constr. Co., 520 North Michigan Ave., $507,927. Noted Dec. 18.

Ky., Louisville—Bd. Educ., 8th and Chestnut Sts., general contract 2 story, basement, brick, stone, to G. H. Rommel Co., 958 Logan St., $242,000; heating, to H. Netherton Co., 114 North 5th St., $46,882. Noted Jan. 15.

Mass., Belmont—Town, Building Comn., W. W. Sperry, 2 story, basement, brick school, plain found., School St., to D'Amore Constr. Co., 89 State St., Boston, est. exceeds $150,000; heating, to R. B. Crocker Co., 107 Mass. Ave., Boston, plumbing, to W. M. Collins Co., 150 Tyler St., Boston, est. $25,000 or more. Noted Jan. 1.

Mich., Monroe—St. Mary's Academy, Servants of the Immaculate Heart of Mary, four 4 and 5 story, brick, rein.-con., steel buildings, incl. academy building, convent and mother house, central dining hall and central heating plant, plain founds., to W. E. Wood Co., Union Trust Bldg., Detroit. Est. $2,500,000. Noted Dec. 18.

Tex., Ozona—Bd. Educ., c/o W. W. West, 3 story, 150 x 180 ft., brick, rein.-con., stone, to Anderson Bros., El Paso. Est. $150,000. Noted Jan. 15.

THEATRES

PROPOSED WORK

Mass., Attleboro—E. M. Loew's Theaters, 216 Tremont St., Boston, theater. To exceed $150,000. Architect not selected.

N. C., Charlotte—Paramount Publix Theaters, Paramount Bldg., New York, soon takes bids general contract theater. $350,000. Noted Feb. 5, under "Charlottesville."

CONTRACTS AWARDED

Calif., South San Francisco—A. J. Eschelbanh, 302 Orange Ave., steel, concrete theater, store, to G. B. Pasqualetti, 2330 Larkin St., San Francisco, $150,000.

Tex., Dallas—C. E. Kennemer, 4301 Overhill Dr., 1 story, 60 x 160 ft., brick, rein.-con., steel, Spanish-type, Oaklawn Ave., to W. Whitley 3009 Knox St. Est. $150,000. Melrose Amusement Co., Dallas, lessee. Noted Dec. 4.

BANKS

PROPOSED WORK

Me., Portland—Fidelity Trust Co., G. P. Gannett, pres., 467 Congress St., 2 story, basement, adjoining building for bank addition, Congress St. $150,000 or more. Architect not selected.

Mass., Boston — Boston Five Cent Savings Bank, W. R. Evans, pres., 30 School St., sketches by Parker, Thomas & Rice, 177 State St., altering and constructing addition. To exceed $150,000. Noted Jan. 8.

CONTRACTS AWARDED

O., Cincinnati—Fifth-Third Union Trust Co., Walnut and 4th Sts., revamping old quarters, incl. terra cotta, to Midland Terra Cotta Co., 105 West Monroe St., Chicago, Ill.; granite, to American Black Granite Co., 228 North La Salle Sts., Chicago, Ill.; hollow tile, to National Fireproofing Co., 228 North La Salle St., Chicago, Ill., mail box chutes, to Cutler Mail Chute Co., Cutler Bldg., Rochester, N. Y.; carpentry and cabinet work, to Robert Mitchell Mfg. Co., 2nd and John Sts.; plumbing and drinking water cooling system, to T. J. Dyer, Court and Sycamore Sts.; electric wiring, to Beltzhoover Electric Co., 4th and Plum Sts. Est. $500,000.

Okla., Oklahoma City — Weary & Alford, archts., 1923 Calumet Ave., Chicago, Ill., general contract superstructure 32 story, 100 x 125 ft., bank and office building, to Manhattan Constr. Co., Court Arcade Bldg., Tulsa, for 1st Natl. Bank & Trust Co., 140 West Main St., H. M. Johnson, pres. Total est. $3,000,000. Noted Dec. 11.

OFFICES

PROPOSED WORK

Del., Wilmington—Delaware School Foundation, A. J. Taylor, vice pres., Du Pont Bldg., plans by Guilbert & Betelle, 20 Branford Pl., Newark, N. J., 3 story, basement, brick, steel office, plain found. $175,000. Noted Feb. 5.

N. Y., New York—United States Trust Co., and Bankers Trust Co., 45 Wall St., 25 story office and bank addition, Wall and Nassau Sts. $5,500,000. **Maturity about May 1.** Shreve, Lamb & Harmon, 11 West 44th St., archts. Noted Jan. 29.

Vt., Bellows Falls—Offices Vermont Newspaper Corp., c/o W. E. Belknap, plans by H. H. Owen, 3 North State St., Concord, N. H., office and manufacturing building. Est. $20,000. This corrects report published in Jan. 15 Daily and Jan. 22 issue.

CONTRACTS AWARDED

Mich., Detroit—A. Kahn, 1000 Marquette Bldg., archt., 8 story, basement, brick, concrete, steel, stone office, store, to J. A. Utley, 700 Harper Ave., for New Center Development Co., Fisher Bros., Fisher Bldg. Noted Jan. 1.

STORES

PROPOSED WORK

N. J., Newark—Owner, c/o C. F. Ackerman, archt., 45 Clinton St., 3 story, basement, brick, steel store, apartment, 322-28 Osborne Terrace, $150,000.

BIDS ASKED

N. J., Irvington (mail Newark)—See "Contracts Awarded."

CONTRACTS AWARDED

Mass., Quincy—E. J. Johnson, c/o Blackall, Clapp & Whittemore & Clark, 31 West St., Boston, archts., 4 story, basement, 50 x 120 ft., brick, stone, steel store, office, plain found., Maple St., to Geo. Gonia Co., 2 Greek Sq., Boston. Est. $150,000.

N. J., Irvington (mail Newark) — United States Realty & Investment Co., 972 Broad St., Newark, 2 story, basement, 80 x 100 ft., brick, steel office, 1015-19 Springfield Ave., separate contracts. $150,000. F. and W. Grand, Inc., 151 Newark Ave., Jersey City, lessee. W. E. Lehman, 972 Broad St., Newark, archt. Noted Jan. 29.

N. J., Newark—Kresge Department Store, A. Schindel, genl mgr., 715 Broad St., general contract altering department store, to Starrett Bros. & Eken, 101 Park Ave., New York. Est. $200,000. Noted Feb. 5.

LOFTS

BIDS ASKED

N. J., Newark—J. Centanni, archt., 142 Market St., bids about Feb. 23, general contract 3 story, basement, brick, steel loft addition, plain found., for Owner, c/o architect. $150,000. Noted Feb. 5.

PUBLIC

PROPOSED WORK

Ind., Brazil—CLUB—City and W. M. C. A., probably build joint buildings. $150,000. Architect not selected.

Ind., Evansville—LIBRARY—Evansville Library Bd. bids during February, 4 story, basement, rein.-con., stone, 5th and Locust Sts. $300,000. Walker & Weeks, 2341 Carnegie St., Cleveland, O., archts. Noted Nov. 6.

Mass., Greenfield—COURT HOUSE—Franklin Co., A. C. Burnham, co. comr., Court House, new court house, Main and Hope Sts. To exceed $150,000. Architect not selected.

N. J., East Newark—MUNICIPAL—Bd. Boro Council, J. Reynolds, mayor, brick, steel. $150,000. **Maturity probably in June.** Architect not selected.

N. J., Englewood Cliffs—BORO HALL—Bd. Boro Council, 2 story, basement, brick, steel boro hall. $150,000. Architect not selected. Project in abeyance. Noted Jan. 8.

N. J., Newark—FIRE HOUSE—Bd. City Comrs., City Hall, revised sketches by F. Grad, 1023 Broad St., Newark, 3 story, basement, brick, steel, plain found., 18th Ave. and Norwood St. $200,000. Noted Feb. 5.

N. J., Perth Amboy—CITY HALL, etc.—Bd. City Comrs., City Hall, will not build city hall and police station. $150,000 or more. Project abandoned. Noted Nov. 27.

N. Y., Beacon—DORMITORY—Dpt. Correction, State Office Bldg., Albany, bids in March, general contract female ward group, chapel, auditorium, at Matteawan State Hospital. Noted Dec. 25.

N. Y., Dannemora — SEGREGATION — Dpt. Correction, State Office Bldg., Albany, bids in March, general contract segregation building. To exceed $150,000. Noted Mar. 20.

N. Y., Long Island City—BORO HALL and COURT HOUSE—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., bids late in spring general contract boro hall and court house. $8,000,000. A. J. Thomas, 2 West 46th St., New York, archt. Noted Oct. 2.

N. Y., Oswego—COUNTY—Bd. Supervs. Oswego Co., E. Hamilton, chn. com., plans by C. H. Fourneir, Oswego, 4 story, brick addition County Clerk's Building.

N. Y., St. George—BORO HALL—J. A. Lynch, pres. Richmond Boro, Boro Hall, 3 story, basement, brick, steel addition, plain found., Bay St. $150,000. **Maturity late in March or April.** F. E. Wall, 576 Oakland Ave., Port Richmond, archt. Noted Dec. 25.

Pa., Pittsburgh—TOWN HALL—Bd. Comrs. Allegheny Co., J. Armstrong, chn., and Bd. P. Wks., 519 Smithfield St., N. F. Brown, dir., sketches town hall, on 140,625 sq.ft. site, Bigelow Blvd., 5th, Tennyson and Ruskin Aves. $6,000,000. Architect not selected.

Ont., Toronto—JAIL—City, brick, steel, stone, concrete jail to replace present Dond jail. $250,000. Architect not selected.

BIDS ASKED

Calif., Whittier—BOYS—Feb. 24, by State Dpt. P. Wks., Sacramento, 2 story, 8,800 sq.ft. floor space brick.

N. J., Elizabeth—COURT HOUSE—Oakley & Son, archts., 1259 Clinton Pl., bids about Apr. 1, 15 story, basement, brick, steel addition, plain found., for Bd. Freeholders Union Co., Court House. $500,000. P. West, 13 Central Ave., Newark, engr. Noted Jan. 8.

N. J., Hackensack—ADMINISTRATION—Bd. Freeholders Bergen Co., Court House, bids about Mar. 1, general contract 6 story, basement, brick, steel administration building, Main and Hudson Sts. $1,200,000. E. L. Tilton & W. F. Schwannwede, 420 Lexington Ave., New York, archts. Noted Dec. 25.

N. J., North Bergen — FIRE HOUSE, GARAGE, SIGNAL STATION—Bd. Town Council, Town Hall, bids about Apr. 1, on revised plans 2 story, basement, brick, steel, rear of town hall. $150,000. R. B. Glenn, Town Hall, archt. Noted Jan. 22.

N. Y., New York—ART MUSEUM—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, bids about Mar. 15, general contract 2 and 3 story museum at Metropolitan Museum of Art, 5th Ave. from 80th to 84th Sts. $3,350,000. J. R. Pope, 542 5th Ave., archt. E. E. Seelye, 101 Park Ave., structural engr. Tenney Ohmes, 101 Park Ave., mechanical engrs. Noted Jan. 15.

CONTRACTS AWARDED

Calif., San Francisco—HOME—S. J. Hester, secy. Bd. P. Wks., City Hall, general contract Laguna Home to be known as Wards K and L, Class A, steel, for City and San Francisco Co., to Anderson & Ringrose, 320 Market St., $324,400; plumbing to Turner Co., 329 Tahama St., $36,370; mechanical equipment, to Scott Co., 243 Minna St., $20,842. Grand total $381,612. Bids rejected for electrical work. Noted Dec. 18.

Tex., Abilene—JAIL—Taylor Co., c/o T. K. Eplen, judge, 4 story, basement, 53 x 57 ft., brick, stone, rein.-con., to Suggs Constr. Co., Abilene, $41,800; electric wiring to Sun Electric Co., Abilene, $1,690; heating, to R. G. Codgell Plumbing & Heating Co., Abilene; plumbing, to Nance-Webb Plumbing Co., Abilene, $7,475; jail equipment, to Southern Prison Co., 4500 South Presa St., San Antonio, $32,500; elevators, to Otis Elevator Co., 1822 Young St., Dallas, $4,095. Grand total, $93,160. Noted Jan. 22.

UNCLASSIFIED

PROPOSED WORK

Calif., Pomona — NEWSPAPER — Progress-Bulletin revised plans by L. Rogers, 2412 West 7th St., Los Angeles, probably 6 story, 120 x 120 ft., rein.-con., 3rd and Thomas Sts. $250,000. Noted Dec. 4.

Constr. News page 67

Unclassified (Continued)

Conn., New Haven — LABORATORY — Connecticut Agricultural Experimental Station, Huntington, New Haven, Jenkins Laboratory for agricultural experiments, brick. $50,000. Architect not selected.

Mo., Kansas City—BUSINESS—J. W. Jenkins Sons Music Co., 1015 Walnut St., plans by C. A. Smith, 800 Finance Bldg., 8 story, basement, brick, steel, rein.-con. addition. $500,000.

N. J., Atlantic City—TERMINAL—Corporation, c/o Pennsylvania R.R. Co., T. J. Skillman, ch. engr., Broad St. Sta., Phila., Pa., union railroad terminal, Artic, Arkansas and Missouri Aves. $5,000,000. **Maturity indefinite.**

N. J., East Orange—BUSINESS—Rocco Realty Co., M. Rousek, mgr., 507 Main St., will not build brick, steel business building, stores, Main St. $150,000. Project abandoned. Noted Jan. 29.

N. J., Hackensack—EXCHANGE—New Jersey Bell Telephone Co., 540 Broad St., Newark, sketches by Voorhees, Gmelin & Walker, 101 Park Ave., New York, exchange, State St. To exceed $150,000. Noted Jan. 29.

N. J., Newark—MARKET—Steuben Holding Corp., 60 Park Pl., revised sketches by F. H. Koenigsberger, 48 Walnut St., 2 story, basement, brick, steel, Washington and Linden Sts. $200,000. Noted Jan. 5.

N. J., Peapack — STABLES — —R. V. N. Gambill, c/o J. C. McKenzie, Jr., 3 East 57th St., New York, soon lets contract 1 and 2 story, basement, 150 x 150 ft., brick, steel, stable group, plain and shoring founds. $150,000. Bids in.

N. Y., Buffalo—EXCHANGE—New York Telephone Co., 44 Church St., bids late in February, general contract telephone exchange, Elmwood Ave. Voorhees, Gmelin & Walker, 101 Park Ave., New York, archts.

Okla., Tulsa—BUS TERMINAL, HOTEL, etc. —C. B. Peters, Exchange Natl. Bank Bldg., and Tulsa Opera Co., sketches 10 story, bus terminal, hotel, office and garage building, 2nd and Cincinnati Sts. $1,500,000. Engineer and architect not selected.

Pa., Phila.—SALES and MAINTENANCE—P. S. Tyre, archt., 1520 Locust St., soon lets contract 1 story, 70 x 218 ft., brick, rein.-con., plain found., Chester Pike and Sellers Ave., Millbourne, for Springfield Realty Co., Commercial Trust Bldg.

R. I., East Providence (br. Providence) — MARKET — Providence Pub. Market Co., O. Swanson, 380 Westminster St., Providence, plans by V. Skoglund, 828 Eddy St., Providence, 2 story, basement, brick, steel, plain found., Taunton Ave. $150,000.

R. I. Providence—HOME—Scandinavian Home for Aged, K. Johanson, 15 Hayes St., home for aged, Broad St. $150,000 or more. Architect not selected.

CONTRACTS AWARDED

Ont., Toronto—MUSEUM—Chapman & Oxley, archts., Sterling Tower, general contract 3 story, basement, brick, concrete, stone, steel addition, for Royal Ontario Museum, Bloor St., to Pigott Constr. Co., Ltd., Pigott Bldg., Hamilton; plumbing, to Ritchie & McIntosh, 126 Wellington St. W.; heating, to Fiddes & Hogarth, 122 King St. E.; ventilation, to Heather & Little, 5 Brooklyn Ave.; electrical work, to Harris & Marsden, 81A Parkway Ave.; electric elevators, to Otis Fenson Co., 170 Bay St. Est. $1,500,000. Noted Jan. 15.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Los Angeles—FACTORY and WAREHOUSE — Benedict & Co. Ltd., (refrigerator manufacturers), sketches by W. P. Neil Co., 4814 Loma Vista Ave., 1 or 2 story, rein.-con., Central Manufacturing Dist. To exceed $150,000.

Calif., Ontario—FACTORY—Edison Electric Appliance Co., 5600 Tayler St., Chicago, Ill., A. D. Byler, in charge, sketches electric range factory. $250,000.

Mass., Leominster—FACTORY—Foster Grant Co., Inc., S. Foster, 240 Lancaster St., 2 story, brick, timber addition, $50,000. Private plans.

Neb., Lincoln—LAUNDRY—See "Hospitals."

N. J., East Rutherford—FACTORY—East Rutherford Syringe Co., 75 Mozart St., revised sketches 2 story, basement, brick, steel, 54 Mozart St. $40,000. Noted Oct. 30.

N. J., Trenton—OIL PLANT—Servusoil Co., c/o H. Welling, 16 Fisher Pl., in charge, five 420,000 gal. tanks for oil plant, on Duck Island, 3 mi. below here. $75,000.

N. J., Wallington — BAKERY, etc.—J. T. Camlet, archt., 26 Piaget Ave., Clifton, soon takes new bids on revised plans 2 story, basement, brick, steel bakery, plant, stores, garages, Wallington Ave. and Mercer St., for J. Barbuta, 103 Halstead St. $40,000. Noted Jan. 29.

N. Y., Syracuse — ACETYLENE PLANT—Union Carbide & Carbon Co., 30 East 42nd St., New York, acetylene (presto-lite unit) plant. $50,000. **Maturity in May or later.**

O., Canton—ACETYLENE GAS MANUFACTURING PLANT—Union Carbide & Carbon Co., 30 East 42nd St., New York, acetylene gas manufacturing plant (presto-lite unit). $50,000. Private plans. **Maturity in May or later.**

BIDS ASKED

N. J., Newark — FACTORY — M. N. Shoemaker, archt., 10 Bleecker St., bids about Mar. 15, general contract altering 2 story, basement, brick, steel, 361-65 6th Ave., for Weldon Roberts Rubber Co., 18 Oliver St. $40,000. Noted Jan. 29.

Pa., Sharpsville—MANUFACTURING PLANT —See "Contracts Awarded."

Tex., Temple—REFINERY—Texas Pacific Coal & Oil Co., Thurber, oil and gasoline refinery plant. $250,000. Private plans. Project indefinitely postponed. Noted Jan. 1, under "contracts awarded."

CONTRACTS AWARDED

Ill., Belleville—FACTORY—Peerless Enameling & Stamping Co., R. G. William, secy., 1 story, 110 x 120 ft., concrete addition, concrete found., 1500 West Lincoln St., to Bergmann & Lutz, 519 Scheel St.

N. J., Newark—NEWSPAPER PLANT—Evening News Publishing Co., 215 Market St., general contract altering newspaper plant, installing turbine, generator, 215 Market St., to F. K. Kilgus, Inc., 13 South 6th St. Est. $40,000.

N. J., Ridgefield—LITHOGRAPH SHOP—Lowe Paper Co., River Rd., general contract 2 story, basement, 100 x 160 ft., brick, steel, to Davis & Averill, Inc., 28 Fulton St., Newark. Est. $50,000. Noted Jan. 15, under "Contracts Awarded."

Pa., Sharpsville—MANUFACTURING PLANT —Sharpsville Boiler Wks., brick, concrete addition, 150,000 sq.ft. floor space, day labor. Work started. Noted Jan. 22.

Va., Amherst—CHEMICAL PLANT—Southern Mineral Products Co., subsidiary Vanadium Corp. of America, 120 Bway., New York, miscellaneous plant additions to Stone & Webster Eng. Corp., 164 Bway., Boston, Mass., subcontract for 100 tons structural steel, to Virginia Bridge & Iron Wks., Roanoke. Est. exceeds $40,000.

Wash., Seattle—ASSEMBLY PLANT—Albert Kahn, Inc., archts., 100 Marquette Bldg., Detroit, Mich., 500 ft. dock, main assembly building, oil house, piling and fender piling for assembly plant, to Clinton Constr. Co., 923 Folsom St., San Francisco, Calif., for Ford Motor Co., 3674 Schaefer Rd., Dearborn, Mich., dredging waterway, filling, removing docks and bulkheads, to Puget Sound Bridge & Dredging Co., Central Bldg. Total est. $3,000,000. Noted Jan. 29.

GARAGES

PROPOSED WORK

Mass., Belmont—Town, Electric Light Dpt., Concord Ave., 1 story, 50 x 110 ft., concrete block garage, storeroom, off Waverly Ave. $45,000. Private plans.

Mass., Fall River—Pilgrim Leasehold Co., 44 School St., Boston, 2 story, 65 x 160 ft., brick, steel garage, stockroom, concrete found., east side of 9th St. $45,000. Private plans.

N. J., Metuchen — Owner, c/o A. M. Korff, archt., 203 Park Ave., Plainfield, brick, steel bus terminal. $150,000. **Maturity probably soon.**

N. J., Paterson—City Planning Comn., B. H. Saunders, City Hall, will not build garage, Straight St. $150,000. Project abandoned. Noted Jan. 23, 1930.

N. Y., Jamaica—Branhill Realty Co., 163-18 Jamaica Ave., sketches by M. Klein, 65 Court St., Brooklyn, 114 x 136 ft. service garage, Archer Ave. and Standard Pl. $50,000.

N. Y., Jamaica — Hyman's New York and Jamaica Express, 143-01 101st Ave., sketches by T. Guterman, 16 Nassau St., Brooklyn, 100 x 200 ft. service garage and shop, 165th St. and Jamaica Ave. $40,000.

N. Y., Ogdensburg — W. E. Griffiths, c/o Ramy Building Corp., 21 East 40th St., will not build service garage. Project abandoned. Noted May 29.

N. Y., Richmond Hill—Metz Auto Sales & Laundry Co., 127-15 Metroplitan Ave., bids about April, general and separate contracts service garage, Metropolitan Ave. and 129th St. Noted May 22.

N. Y., Syracuse — Niagara Hudson Power Corp. soon takes bids 2 story, 100 x 200 ft., rein.-con. garage. $100,000. Bley & Lyman, 505 Delaware St., archts.

N. Y., White Plains—Jasamore Realty Co., c/o S. M. Salke, 489 5th Ave., New York, service garage, 85th South Lexington Ave. $100,000. **Maturity about April or later.** Noted Oct. 9.

S. C., Columbia—Standard Oil Co. of New Jersey, 709 Pendleton St., Columbia, service station, garage, Gervais and Marion Sts. $40,000.

BIDS ASKED

Pa., Pittsburgh—E. G. Hartje, 5622 Aylesboro St., taking bids 1 story, 37 x 72 ft., brick, tile service building, 4900 Baum Blvd. $40,000. R. M. Reutti, Whitfield Bldg., archt.

CONTRACTS AWARDED

Ind., Lebanon—Sinclair Oil Co., general contract brick, steel super-service station, Main and Indianapolis Sts., to H. C. Carr & Son, 614 West Chicago St. Est. $43,000.

Ind., South Bend—Goodrich Rubber Co., 500 South Main St., Akron, O., rein.-con., steel, brick super-service station, Lafayette and Colfax Sts., to R. Sollitt & Sons, South Bend. Est. $40,000.

Mass., Braintree — Old Colony Gas Co., E. Farnsworth, Quincy Ave., 2 story, brick, rein.-con., steel storage and sales building, concrete found., Quincy Ave., to C. C. Temple Co., 99 Chauncy St., Boston. Est. $40,000.

Pa., Greenville—Sterling Oil Co., R. S. Newton, in charge operation, Emlenton, 1 story, brick, steel service station, to C. H. Stoyer, Hittle Ave. Est. $40,000. Noted Dec. 11.

SHOPS AND FOUNDRIES

PROPOSED WORK

Mass., Springfield—SHOP, etc.—City, W. H Dagget, fire chief, Court St., repair shop and signal station, State St. $40,000.

BIDS ASKED

N. Y., Maspeth—STEEL SHOP—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Redwood City—MACHINE SHOP, etc. —Pacific Gas & Electric Co., 445 Market St., San Francisco, timber, tile service buildings, shops depts., to Clinton-Stephenson Co., Monadnock Bldg., San Francisco, $40,000.

N. Y., Maspeth—STEEL SHOP—Jones & Larsen, 58-61 55th St., 99 x 100 ft. steel shop, equipment, Furman Ave. and Grand St., day labor and separate contracts. $40,000. Private plans.

POWER PLANTS

PROPOSED WORK

Calif., Alhambra—City new power and light plant, Burns & McDonnell Eng. Co., 400 Interstate Bldg., Kansas City, Mo., engrs.

Calif., Palo Alto—City municipal power plant, Burns & McDonnell Eng. Co., 400 Interstate Bldg., Kansas City, Mo., engrs.

Calif., San Mateo—City, municipal power plant, Burns & McDonnell Eng. Co., 400 Interstate Bldg., Kansas City, Mo., engrs.

Mass., Springfield—United Electric Light Co., J. P. McKearin, ch. engr., 73 State St., substation, Page Blvd. and Roosevelt Ave., East Springfield. $40,000. Private plans.

N. Y., Buffalo — University of Buffalo plans by Green & Hopkins, Niagara Square Bldg., central heating plant for university buildings. J. W. Danforth Co., 70 Ellicott Sq., engrs.

Man Winnipeg — Northwestern Power Co. Ltd., Electric Railway Chambers, sketches 1 story, 86 x 90 ft., brick electrical sub-station, concrete found., Harrow St., near Pembina St. $300,000.

BIDS ASKED

Ind., West Lafayette (br. Lafayette)—Purdue University, R. B. Stewart, comptroller, bids about Mar. 1, rein.-con., brick power plant addition. $100,000. W. Scholer, 210 Wallace Bldg., Lafayette, archt.

Kan., Kansas City—Feb. 18, by Bd. P. Utilities, C. A. Lowder, secy., City Hall, pumps, wiring for new power plant addition to municipal water and light plant, Contr. 19; Feb. 25, wiring for new power plant addition, Contr. 18. Burns & McDonnell Eng. Co., 406 Interstate Bldg., Kansas City, Mo., engrs.

CONTRACTS AWARDED

Nev., Las Vegas—Southern Sierras Power Co., c/o California Nevada Electric Co., Riverside, Calif., condensers, transformers, power plant equipment, to Westinghouse Electric & Mfg. Co., 150 Bway., New York. Est. exceeds $50,000.

WAREHOUSES

PROPOSED WORK

Mass., Boston—F. Johnson, 209 Washington St., rebuilding 2 story, brick storage building, plain found., Union and Main Sts. $40,000. Private plans.

Mass., Taunton—Peter H. Corr Waste Co., 38 Court St., rebuilding 2 brick, concrete storage units, Court St. $50,000. Architect not selected.

N. J., Weehawken — Bonanno Weehawken Warehouse Co., 1827 Bergen Turnpike, 5 story, basement, brick, steel, rein.-con. warehouse, Park Ave. and 19th St. $500,000. Project in abeyance. Noted Jan. 29.

N. Y., Northport—Long Island Lighting Co., Woodbine Ave., industrial warehouse. To exceed $75,000. **Maturity about May 1 or later.** Private plans. Noted Oct. 16.

BIDS ASKED

N. J., Perth Amboy—Feb. 17, by Ballinger & Co., archts., 12th and Chestnut Sts., Phila., Pa., general contract 1 story, basement, brick, steel, rein. con. warehouse, Fayeth and Read Sts., for Greenspan Bros., 226 Washington St. $300,000. Noted Jan. 22.

N. C., Charlotte—Swift & Co., Packers and Exchange Aves., Chicago, Ill., taking bids general contract warehouse, distribution (refrigeration) plant. To exceed $40,000. Private plans.

CONTRACTS AWARDED

N. Y., Yonkers—John Wanamaker, Bway. and 9th St., New York, general contract distributing warehouse, to P. M. Sterling, 230 Park Ave., New York; steel, to Kues Bros., Carter Ave. and 175th St., New York. Est. $40,000. Foundations under way. Noted Nov. 6.

R. I., East Providence (br. Providence)—Artesian Well & Supply Co., c/o E. B. Whipple, engr., 87 Weybosset St., Providence, 1 story, 85 x 100 ft., brick, steel, storage building, plain found., to O. D. Purrington & Co., 49 Westminster St., Providence. Est. $40,000. Noted Jan. 15.

Constr. News page 68

See proposal advertising on page 95